ABSTRACT

Title of Thesis: RESTORING FLOODPLAIN FUNCTION: INTEGRATING ECOLOGICAL RESTORATION, WATER QUALITY, AND HUMAN USE IN A PUBLIC PARK IN HYATTSVILLE, MARYLAND

Lillian Austin, Master of Landscape Architecture, 2026

Thesis directed by: Dr. Christopher Ellis, Plant Science and Landscape Architecture

Urban ecosystems and hydrologic function are impacted by urban development. Flooding and poor water quality persist in Mid-Atlantic communities due to impervious surfaces and disrupted hydrology. This thesis asks how landscape architects can restore ecological and hydrological function in a disturbed urban floodplain to improve water

quality, increase biodiversity, and support public stewardship. The study centers on a site in Hyattsville, Maryland, and develops a design proposal centered on a daylighted channel and multi-cell wetland system. Hydrologic modeling and ecological assessment are used to evaluate the project's potential to slow, spread, and infiltrate stormwater, improve habitat complexity, and support more diverse native plant communities. The evidence suggests that restoring ecological and hydrological function through integrated stormwater and landscape design can improve environmental performance while creating visible, accessible spaces that encourage long-term care and stewardship.

RESTORING FLOODPLAIN FUNCTION: INTEGRATING ECOLOGICAL RESTORATION, WATER QUALITY, AND HUMAN USE IN A PUBLIC PARK IN HYATTSVILLE, MARYLAND

by

Lillian Austin

Thesis submitted to the Faculty of the Graduate School of the
University of Maryland, College Park, in partial fulfillment
of the requirements for the degree of
Master of Landscape
Architecture
2026

Advisory Committee:
Professor Christopher Ellis, Chair
Professor David Myers
Professor Andrew Baldwin
Lisa Kuder

© Copyright by

Lillian Austin

2026

Dedication

For my daughter Caitriona, the one I want to make a better world for, and in memory of my mother, who inspired my love of nature.

Acknowledgements

Thank you to my husband, for his unwavering confidence.

Thank you to my cohort, I could not have done this without you.

Thank you to my committee for their time and support.

Thank you to Greg Smith and Sustainable Hyattsville for bringing the project to the department.

Table of Contents

Contents

Dedication ii

Acknowledgements iii

Table of Contents iv

List of Figures vii

List of Abbreviations ix

Chapter 1: Introduction 1

Problem Statement 1

Research Question 1

Objectives 2

Definitions 3

Chapter 2: Literature Review 5

Overview 5

Urban Flooding and Stormwater Systems 6

Water Quality 7

Improving Water Quality with Constructed Wetlands 8

Ecological Function in Urban Landscapes 9

Restoring Hydrology and Ecological Function in Urban Landscapes 10

Biodiversity and Habitat Restoration 14

Stewardship and Public Engagement 15

Literature Informed Criteria 18
Chapter 3: Methods 24
Mixed Methods Approach 24
Research Through Design 24
Iterative Research and Design 26
Chapter 4: Site Analysis 27
Understanding the Site 27
Regional Context 29
Chapter 5: Design 44
Design Overview 44
Conceptual Design 44
Concept 1: Daylighted Channel 44
Concept 2: Sediment Catchment Pond 47
Concept 3: Multi-cell Wetland System 49
Hydrologic Function 53
Regenerative Stream Conveyance 54
Beaver Dam Analog 54
Planting and Habitat Zones 56
Proposed Materials 60
Paths 60
Overlook Bridge 61
Chapter 6: Discussion 63
Design Evaluation 63

Biodiversity 63
Hydrologic and Ecologic Function 65
Water Quality 66
Stewardship and Maintenance 67
Limitations to the Methods 68
Tradeoffs between Criteria 69
Contribution to the Practice of Landscape Architecture 71
Chapter 7: Conclusion 73
Appendices 75
Full Plant Palette 75
TR-55 Data 82
Additional Imagery 89
Bibliography 90

List of Figures

Figure 1 Beaver Dam Analogs can be built and maintained by volunteers with guidance (Morrow Bay National Estuary Program, 2026). 12

Figure 2 The site, marked by the red indicator, is located just North of Washington DC. (Google, 2026) 29

Figure 3 The site, marked in red, is located within the Anacostia Watershed, a predominantly urbanized and impervious area. (ArcGIS, 2025) 30

Figure 4 The Drainage watershed,outlined in blue, shows the areas contributing runoff ot the site, outlined in red. (ArcGIS, 2026) 31

Figure 5 The soils consist of ChD, Christiana–Downer–Urban land complex, RuB, Russett–Christiana–Urban land complex, and Ch, Codorus-Christian-Urban land complex soils. (NRCS, 2025) 32

Figure 6The drainage watershed contains entirely hydro group D soils, soils that contribute to higher stormwater runoff. The slopes are shown with red being the steepest and green being the lowest (ArcGIS, 2026). 33

Figure 7This hydrograph shows the rate of runoff over time. The high peak shows that the watershed has a high and fast runoff and water runs into the site at a fast pace. (WinTR-55) 34

Figure 8This site inventory diagram shows how where the stormwater pipe runs under the site and exits into the adjacent wetland. 35

Figure 9The FEMA floodplain map shows the site, outlined in black, sits within the 100 and 500 year floodplain. (ArcGIS, 2025) 36

Figure 10An existing Palustrine Wetland sits to the South of the site and receives the water from the stormwater pipe running under the site. 37

Figure 11The soils consist of ChD, Christiana–Downer–Urban land complex, RuB, Russett–Christiana–Urban land complex, and Ch, Codorus-Christian-Urban land complex soils. (NRCS, 2025) 39

Figure 12 Site contours appear to show historical grading to flatten the land. (ArcGIS, 2025) 40
Figure 13 The site may have been the rallying point for the 1913 Women's Suffrage motorcade. (Records of the National Woman's Party, Manuscript Division, Library of Congress) 43
Figure 14 Concept 1 is a simple daylighting of the stormwater flow. 46
Figure 15 Concept 2 is a large sediment catchment pond. 48
Figure 16 Concept 3 is a multi-cell system containing a sediment pond and two wetland cells. 51
Figure 17 Diagrammatic Design Plan 53
Figure 18 Each color represents a different planting condition and group of proposed plants to suit the condition. 57
Figure 19 Design Render showing the entrance path leading to the existing playground. 61
Figure 20 Design render of the observation bridge. The bridge gives visitors the opportunity to observe ecological processes. 62
Figure 21 This table shows the calculations for treatment. The calculations show the proposal is projected to treat 38.22% of the watershed runoff. 66
Figure 22 This chart shows the calculated pollution load of the existing conditions versus the proposed design and the projected reduction in pollution load. 67
Figure 23 Land Use Details shown from the drainage watershed. 82
Figure 24 WinTR20 Report on the projected design outcomes 83
Figure 25 Design Render showing the view from the Observation bridge looking South towards the existing wetlands. ..... **Error! Bookmark not defined.**
Figure 26 An example of educational signage for the proposed design. Created by the author for a community event. 89

List of Abbreviations

BDA: Beaver Dam Analog

TMDL: Total Maximum Daily Load

Chapter 1: Introduction

Problem Statement

Urban ecosystems and hydrologic function are impacted by urban development. Urban flooding and declining water quality persist as significant challenges in contemporary cities, particularly in areas where expanding impervious surfaces disrupt natural hydrologic systems. In the Mid-Atlantic region, these effects are exacerbated by aging infrastructure, historical land-use patterns, and regulatory measures such as Total Maximum Daily Load (TMDL) requirements. Traditional stormwater management strategies often emphasize rapid conveyance through engineered systems, thereby limiting opportunities to restore ecological processes and weakening the connection between people and water within the landscape.

Disturbed urban floodplain sites present both challenges and opportunities. These areas are often limited by frequent flooding, degraded soils, and existing infrastructure. Nevertheless, they retain ecological potential, especially where hydric soils and remnants of historic water systems persist. Innovative design approaches are required to move beyond conventional infrastructure, reestablish ecological function, and encourage public engagement and long-term maintenance.

Research Question

This thesis is driven by the core research question: How can landscape architects restore ecological and hydrological functions in a disturbed urban floodplain to improve water quality, enhance biodiversity, and foster public stewardship?

This proposal employs a mixed-methods approach, investigating this question by designing a public landscape in Hyattsville, Maryland. The site, situated within the floodplain, is characterized by hydric soils and an existing subsurface stormwater pipe. This context serves as the basis for integrating ecological restoration with stormwater management.

Objectives

The design is guided by four primary objectives: increasing habitat and biodiversity through native plant communities; restoring ecological and hydrological functions by enabling water to slow, spread, and infiltrate; improving water quality by reducing sediment and nutrient loads; and promoting long-term stewardship through enhanced visibility, access, and engagement. These objectives translate the research questions into measurable design criteria that structure the development and evaluation of the proposal.

This thesis contends that restoring ecological and hydrological functions in disturbed urban floodplains can enhance water quality and biodiversity. These outcomes are achieved by enabling water to slow, spread, and infiltrate through native plant communities. Incorporating these processes into accessible landscape design can further support long-term public stewardship.

These criteria inform the design and evaluation of the proposed intervention, which includes daylighting an existing stormwater pipe and installing a multi-cell wetland treatment system. The performance of the design is assessed using hydrologic modeling and ecological evaluation tools. This approach positions landscape architecture as a critical discipline for integrating ecological systems, infrastructure, and human experience to advance urban resilience.

Definitions

Anaerobic: An environment lacking free oxygen. In wetland soils, this condition slows decomposition and changes microbial activity (Craft, 2022).

Anthropocene: A human-dominated geological epoch (Karen Holl, 2020)

Ecological restoration: Ecological restoration is the process of assisting the recovery of an ecosystem that has been degraded, damaged, or destroyed (Karen Holl, 2020).

Disturbances: Natural or human-mediated events or activities that change the structure, species composition, and/or function of an ecosystem. Disturbances may be beneficial or deleterious, depending on their type, intensity, scale, and frequency with respect to adaptions of particular organisms (Karen Holl, 2020).

Ecosystem Function/Process: An intrinsic ecosystem characteristic whereby an ecosystem maintains its integrity. Ecosystem processes include decomposition, production, nutrient cycling, and emergent properties resulting from species interactions such as competition, seed dispersal carried out by animals, and mutualistic relationships. Some ecosystem processes can deliver ecosystem services and goods to humans (Karen Holl, 2020).

Ecosystem Services: The direct and indirect contributions of ecosystems to human well-being. They include the production and maintenance of clean soil, water, and air; the moderation of climate and disease; nutrient cycling; and pollination; the provisioning of a range of goods useful to humans; and potential for the satisfaction of aesthetic, recreation, and other human values (Karen Holl, 2020).

Floodplain: An area of land adjacent to a river or stream that is subject to periodic flooding (Craft, 2022).

Hydric Soil: Soil that is saturated, flooded, or ponded long enough during the growing season to develop anaerobic conditions (Craft, 2022).

Hydrograph: A two-dimensional figure that illustrates the depth, duration, frequency, and seasonality of inundation or saturation in a wetland (Craft, 2022).

Hydrology: The spatial and temporal patterns of flooding or soil saturation in a wetland (Craft, 2022).

Chapter 2: Literature Review

Overview

This chapter covers the theoretical and technical knowledge needed to address the central research question: How can landscape architects help restore ecological and hydrological functions in a disturbed urban floodplain to improve water quality, enhance biodiversity, and foster public stewardship? The previous introduction discussed key challenges, including urban flooding, declining water quality, and the regulatory context of the Mid-Atlantic region. It argued that disturbed urban floodplains offer unique opportunities for integrated ecological design.

The following sections synthesize key concepts from ecological restoration, urban hydrology, and landscape stewardship. These concepts are used to construct an inclusive framework for the proposed design intervention. The literature review is organized around four main objectives: restoring ecological and hydrological functions, improving water quality, enhancing biodiversity, and inspiring stewardship.

Specifically, this review analyzes the following topics:

1. Urban Flooding and Stormwater Systems: This section reviews the differences between gray and green infrastructure for managing runoff and infiltration in cities.
2. Water Quality: This section outlines key stormwater pollutants, TMDL regulations, and the importance of the "first flush."
3. Ecological Function in Urban Landscapes: This section defines essential ecological functions, such as water movement, nutrient cycling, and habitat support, and examines how urbanization disturbs these processes. Particular attention is given to the key role of wetlands in maintaining ecological functions.

4. Restoring Hydrology and Ecological Function: This section summarizes urban restoration strategies, including nature-based solutions like BDAs and constructed wetlands.
5. Plant Communities and Succession: This section discusses native plants, succession, and the critical role of diverse vegetation.
6. Biodiversity and Habitat Restoration: This section highlights the role of native species and the human benefits of biodiversity.
7. Stewardship and Public Engagement: This section reviews the role of visible, educational design and visitor involvement in stewardship.

Through integrating these topics of inquiry, this literature review establishes the foundation for the design criteria, supplying a basis for the site analysis and the development of the proposed multi-cell wetland system in the following chapters.

Urban Flooding and Stormwater Systems

Urban development greatly increases impervious surfaces, areas such as roads, parking lots, and rooftops, where water cannot soak into the ground. The resulting higher runoff volumes and elevated peak flow rates, combined with reduced infiltration, alter stream health. Meanwhile, traditional gray infrastructure, including storm drains and pipes, rapidly conveys water off-site. As a result, natural filtration processes that could otherwise improve water quality are often bypassed (MD DNR, n.d.).

Green infrastructure offers an alternative that works with, not against, natural systems. Green infrastructure reduces runoff and improves infiltration more effectively than gray infrastructure. Practices such as constructed wetlands, bioretention systems, and bioswales imitate natural processes. They facilitate water treatment, retention, and infiltration through biological mechanisms. These systems protect streams, reduce pollution, and also mitigate soil erosion and sediment accumulation (Randolph, 2003).

In contrast, gray infrastructure, such as pipes and concrete channels, moves water quickly from one location to another. This often transfers environmental problems downstream rather than resolving them. Considering both function and broader community impacts, green infrastructure offers benefits besides environmental performance. Unlike concrete systems or buried streams, these landscapes present visually attractive environments. They let communities observe ecological processes and develop an appreciation for natural systems (Randolph, 2003). This thesis focuses on restoring hydrologic function and ecological processes through green infrastructure, while also addressing how the public perceives and maintains these systems.

Water Quality

Focusing now on water quality, urban stormwater runoff contains a wide range of pollutants that negatively impact aquatic systems. Heavy metals can leach from roofing materials, while parking lot sealants composed of polycyclic aromatic hydrocarbons (PAHs) degrade and enter storm drains through vehicle activity and rainfall (National Research Council, 2009).

Building on these concerns, an environmental report modeling Total Maximum Daily Loads (TMDLs) found further evidence of water quality degradation in the Anacostia River watershed. Numerous pollutants were identified in the report. Among them were organochloride pesticides such as DDT, which bind to sediments and are released upon disturbance. Also present were PAHs such as acenaphthene, anthracene, and fluorene, as well as metals including arsenic, copper, and zinc. Entering waterways through multiple pathways, these contaminants originate mainly from stormwater runoff from impervious surfaces in urbanized areas (Tetra Tech, 2021).

TMDLs, or Total Maximum Daily Loads, serve as a regulatory framework for managing these pollutants. A TMDL is the maximum amount of a specific pollutant that can be discharged into a water body while still meeting federal water quality standards (WQS). The calculation typically distinguishes

between regulated sources and nonpoint source (NPS) pollution: Total discharge allocations to regulated sources = TMDL – Natural Nonpoint Source (NPS) pollution (Randolph, 2003, p. 440).

Stormwater also transports sediment and nutrients, such as nitrogen and phosphorus, into receiving waters (National Resource Council, pg 190). The concentration of pollutants is often highest during the “first flush.” This event occurs at the start of runoff and carries accumulated contaminants from impervious surfaces. First flush can occur during both rainfall and snowmelt events (National Research Council, p. 199).

As a result, these pollutants are rapidly conveyed into streams and wetlands, placing stress on ecosystems and, in some cases, causing the death of aquatic organisms (How Impervious Surface Impacts Stream Health).

Improving Water Quality with Constructed Wetlands

Constructed wetlands are especially effective for water quality treatment. They remove significant amounts of sediment and reduce nutrient loads, with median removal rates of 76% for total suspended solids, 49% for phosphorus, and 30% for nitrogen (Randolph, 2003). Constructed wetlands are manufactured systems designed to clean contaminated water, such as wastewater or stormwater (Interagency Workgroup on Constructed Wetlands, 2000). They improve water quality by relying on the natural cleaning abilities of wetland plants, soils, and the tiny organisms—like bacteria—that live there (Interagency Workgroup on Constructed Wetlands, 2000). To make this natural cleaning process work as effectively as possible, these wetlands are specifically designed to slow the incoming water (Interagency Workgroup on Constructed Wetlands, 2000). This prevents "short circuiting," a problem where water moves too quickly through the system and does not spend enough time interacting with the cleaning plants and soils. A common way to achieve this is to use a multiple-cell design, which means dividing the wetland into separate, connected sections. For example, the first section might be a deep pool designed to

slow the rushing water and allow heavy dirt to sink to the bottom. After that, the water flows into the following sections, filled with plants that strip out remaining pollutants, such as excess nutrients and algae. By combining careful water routing, the settling of heavy dirt, and natural filtering by plants, these systems successfully clean polluted water while also creating a home for wildlife (Interagency Workgroup on Constructed Wetlands, 2000)

Ecological Function in Urban Landscapes

Ecological function refers to the processes through which ecosystems operate. These include water movement, nutrient cycling, soil development, and habitat support. Urbanization affects these processes through the widespread use of concrete and other impermeable materials (Craft, 2022).

Gray infrastructure alters natural hydrologic function by stopping water from interacting with the landscape. Instead of infiltrating into the ground or spreading across floodplains, water moves rapidly across impermeable surfaces. In natural systems, streams and rivers interact dynamically with soils and vegetation, exchanging nutrients and supporting diverse plant communities. Rather than confining water, these systems are made to spread and slow it (Palmer et al., 2005).

Wetlands play a particularly important role in maintaining ecological function. They improve water quality by depositing sediment and cycling nutrients. Riparian forested wetlands connect streams to floodplains and intercept stormwater, while freshwater marshes reduce nitrogen and phosphorus loads. Saline marshes contribute to shoreline stabilization and erosion control and provide habitat for marine species (Craft, 2022).

Microbial activity within wetland soils enhances water quality. The saturated, anaerobic (low-oxygen) conditions support bacteria that facilitate denitrification, a process that converts harmful nitrates and sulfates into harmless nitrogen gas, thereby removing these excess nutrients from the water (Craft,

2022). Plant communities add ecosystem services, such as carbon sequestration and stormwater management (Narango et al., 2020).

For the purposes of this thesis, key ecological functions include hydrologic flow and infiltration, nutrient uptake, habitat provision, and soil processes.

Restoring Hydrology and Ecological Function in Urban Landscapes

The Argument for Restoration

Restoration is necessary because human activity has changed natural systems, especially in cities. These changes have disrupted hydrology, altered rainfall patterns, and reduced biodiversity. As a result, many ecosystems now risk greater degradation and extinction.

Conservation is best for protecting intact ecosystems, but it is often not feasible in heavily urbanized areas that have already been disturbed. In these contexts, ecological restoration becomes critical. As Holl notes, restoration can deliver ecosystem services more cost-effectively than engineered solutions (Karen Holl, 2020).

How can stormwater be slowed, distributed, and infiltrated within a constrained urban floodplain site to restore hydrologic function?

A key principle of restoration is to reestablish natural hydrologic processes by slowing, spreading, and infiltrating water. The “sponge city” initiative in China follows this approach, designing landscapes to absorb and manage stormwater. This strategy preserves natural systems, such as wetlands, and adds green infrastructure, including bioswales, green roofs, and retention ponds. It also incorporates gray infrastructure where necessary (Jiang et al., 2018). While large-scale implementations of sponge

city strategies are challenging in the United States owing to regulatory constraints, their principles can be adapted to smaller-scale projects (Gies, 2022).

At the site scale, disconnecting impervious surfaces and directing runoff to pervious areas can greatly reduce runoff volume. Allowing water to spread as sheet flow over vegetated surfaces promotes infiltration and delays its entry into stormwater systems (National Research Council, 2009).

Floodplain reconnection is a further vital restoration strategy. Infrastructure can separate streams from their floodplains, disrupting processes such as nutrient exchange, habitat connectivity, and sediment settling. Reconnection through grading or levee removal restores natural functions like flood storage, water purification, and biodiversity enhancement (Palmer et al., 2005).

The Ecological and Hydrologic Benefits of Beaver Dam Analogs

Beaver Dam Analogs (BDAs) have become a low-cost and effective technique for restoring stream ecosystems. They mimic the historical geomorphic functions of natural beaver dams. Human-made BDAs jump-start ecological recovery by driving hydraulic and biological shifts. These shifts help establish favorable conditions for wildlife recolonization (Pollock et al., 2014)

One of the main hydrologic advantages of BDAs is their ability to slow stream velocities. When streams slow, floodplains reconnect and store additional water in the hyporheic zone beneath the streambed. This stored subsurface water reenters the stream as cool water during the summer's hottest periods. In this way, BDAs help lessen the warming and drying effects associated with climate change. Another benefit is that the higher water table created by BDAs supports the growth and expansion of native riparian vegetation in previously degraded areas (Pollock et al., 2014).

Unlike rigid, highly engineered stream interventions, BDAs offer significant benefits in terms of structural adaptability and ecological connectivity. Stream restoration initiates highly complex and dynamic hydraulic conditions, and BDAs can be quickly and simply altered to react to these landscape changes. Practitioners can reshape the woven materials and install additional posts to respond to new environmental changes. The BDAs are made from natural materials, such as willow, red osier dogwood, and conifer boughs, which ensures the structures preserve porosity (Pollock et al., 2014).

From a financial and extended sustainability perspective, BDAs provide unique project benefits. Their construction depends on relatively simple, low-tech methods and locally sourced materials, which keeps costs low and provides excellent opportunities for volunteer and community participation (Pollock et al., 2014).

Figure 1 Beaver Dam Analogs can be built and maintained by volunteers with guidance (Morrow Bay National Estuary Program, 2026).

Plant Communities and Succession

Plant communities are fundamental to ecological restoration. A diverse range of native species is necessary to support ecosystem functions such as carbon sequestration and habitat provision (Narango et al., 2020). Additionally, plant communities must be resilient, particularly in floodplain environments in which periodic disturbance is expected (Palmer et al., 2005).

Restoration must also consider ecological succession. Plant succession is the natural process by which plant and animal communities change and replace one another over time, and it is an important concept for planning the restoration of damaged environments. Understanding this process helps people predict the specific pathways and the speed at which a degraded area will heal. Planning for these changes is important because, as plant types shift, the way the entire environment functions, such as how it uses energy and recycles nutrients, also evolves. In the early stages of a recovering area, the environment grows rapidly but lacks a large total plant and animal biomass; it features simple food chains and relies heavily on gathering nutrients from the surrounding environment. As the area matures over time, it shifts toward having much more complex food webs that recycle dead plant matter, it keeps its own nutrients trapped inside rather than losing them, and it uses most of its energy just to keep all the living things alive instead of focusing on rapid new growth. People trying to restore damaged areas need to plan for these natural shifts so the environment can eventually heal (Craft, 2022). For example, they often use helpful "nurse plants" which are “adult plants that shelter young seedlings and improve harsh physical conditions, to help other species survive and grow (Craft, 2022, pp. 69-70). They also have to take steps to ensure the soil has sufficient basic nutrients, such as nitrogen, to support a lasting environment. By understanding how these natural changes work, managers can predict how long recovery will take and determine the deliberate efforts needed to restore a damaged site to a healthy, stable state (Craft, 2022). Early successional species create conditions that enable later species to thrive. In disturbed environments, invasive species can dominate, requiring intervention to establish beneficial plant communities. Strategies

such as planting “nurse plants” can facilitate succession by improving site conditions and supporting biodiversity. Plant selection has to align with project goals and consider characteristics such as growth rate, form, nutrient tolerance, and ecological interactions (Karen Holl, 2020).

Biodiversity and Habitat Restoration

Native Plant Communities

Native plant communities are vital for supporting biodiversity. One important study points out the importance of “keystone” plant species, which are necessary for supporting caterpillar populations, an essential food source within ecosystems. The loss of these plants leads to chain reactions throughout the food web (Narango et al. 2020). In the study, the authors examined some of the smallest members of the food web, caterpillars. According to the study, caterpillars (Lepidoptera) are one of the most important sources of protein for other animals. They transfer more energy from plants to other animals than all other herbivores combined. Those caterpillars often have a special relationship with specific plants. Caterpillars often have special adaptations that restrict them to eating specific plant lineages. If the plants the caterpillars rely upon are removed from an area, the caterpillars cannot survive in that space. The plants these caterpillars rely on are referred to as “keystone” species, as these plants are the required pieces to the food web structure. Without them, the rest of the food web suffers. This is especially problematic in urban spaces, where they continue to lose green areas, particularly natural areas with native plants. Landscapes that lack the keystone species produce up to half the number of caterpillar species as those that contain keystone species. However, the study also notes that keystone species alone cannot sustain the entire system. A variety of species is necessary for other functions to continue (Narango et al., 2020).

Urban Biodiversity

Urbanization has significantly reduced biodiversity. Impervious surfaces disrupt root systems, while roads and buildings fragment habitats and create barriers to species movement. These conditions lead to declining populations and elevated mortality rates (Aronson MFJ et al., 2014).

Although these challenges exist, remnant natural areas within cities function as critical refuges for biodiversity and must be preserved. Studies indicate that cities retain only a small fraction of native species compared to non-urban areas (Aronson MFJ et al., 2014).

Biodiversity also benefits human health. Research from Finland demonstrates that increased exposure to biodiverse environments improves children's microbiomes, which are linked to immune function as well as overall health (Haahtela et al., 2023).

Stewardship and Public Engagement

Cues to Care

Nassauer's concept of "cues to care" stresses the importance of visual order in ecological design. Landscapes that appear unmanaged or "messy" are often rejected by the public, regardless of their ecological value. Through incorporating recognizable design elements such as mowing patterns or structured plantings, designers can communicate intentionality and encourage acceptance (Nassauer, 1995).

Ecological Processes and Education

The visibility of ecological processes and the integration of ecological education are essential to supporting cultural sustainability and the long-term protection of healthy landscapes. Human interactions with the environment occur largely through a "perceptible realm," which limits the ability to recognize underlying ecological quality directly (Gobster et al., 2007). As a result, ecologically beneficial

landscapes may not be socially supported if they are perceived as unattractive or disorderly. Addressing this disconnect requires purposeful design interventions that make ecological functions more visible and aesthetically legible. This can be attained by incorporating recognizable cues to care into naturalistic landscapes, thereby aligning ecological performance with prevailing aesthetic expectations. In addition, ecological education operates as a critical tool, molding the cognitive and emotional processes that influence how individuals regard and value landscapes. Through strategies such as interpretive signage, media resources, and guided experiences, education can reveal the environmental importance of less visually attractive environments, such as wetlands, and highlight the risks associated with seemingly attractive but harmful invasive species. These efforts help cultivate an ecological aesthetic that aligns with public perceptions, enjoyment, and behavior, grounded in the principles of ecosystem health (Gobster et al., 2007).

The Role of the Landscape Visitor

The role of visitors within a landscape goes beyond passive use to active participation in the long-term preservation and protection of natural environments. Through repeated and substantive engagement with protected areas, visitors develop emotional connections and a foundational “ethic of care” toward the natural world (Fowler et al., 2020). These emotional connections encourage individuals to participate in environmental stewardship activities, transforming recreational experiences into opportunities for direct involvement, such as trail maintenance, water quality monitoring, and river clean-up efforts. In this way, visitors become contributors to collaborative stewardship initiatives that help mitigate large-scale environmental issues, including climate change and biodiversity loss. This dynamic fosters a mutually beneficial relationship between park managers and the public (Fowler et al., 2020).

Research Gap

The largest gaps in the literature revolved around connecting natural systems in urban environments. The systematic literature review by Khirfan, Mohtat, and Peck found that a few topics in stream restoration are lacking. 'Built form and urban design' and 'inclusive planning' are less discussed themes in the stream daylighting literature. This thesis fills this gap by concentrating on integrating the daylighted stream into the urban fabric. This entails considering landscape design, public spaces, and the stream's influence on urban morphology. The article additionally highlights the lack of clear connections between stream daylighting and climate change adaptation and mitigation in the literature (Khirfan et al., 2020).

Similarly, no literature was found linking Beaver Dam Analogs to daylit streams in urban areas. Much of the research on BDAs is conducted in open green space; therefore, a case study of the use of a beaver dam analog in a tight urban setting could not be found.

This project proposes nature-based solutions to address climate problems, exploring the role of landscape architecture and ecological restoration in stormwater management and biodiversity enhancement.

Literature Informed Criteria

Knowledge from existing literature was used to create set of criteria to inform design and evaluation of the proposed intervention for the Hyattsville site, which includes daylighting an existing stormwater pipe and installing a multi-cell wetland treatment system. The performance of the design is assessed using hydrologic modeling and ecological evaluation tools.

Increase Habitat and Biodiversity

Increasing habitat and biodiversity is a primary design objective supported by the literature, particularly in response to the ecological losses associated with urbanization. This goal can be achieved by establishing multiple resilient native plant communities adapted to site-specific conditions and capable of supporting native wildlife. Urban environments have been shown to retain only a fraction of their original biodiversity, with cities maintaining approximately 8% of native bird species and 25% of native plant species density compared to non-urban areas (Aronson MFJ et al., 2014). This decline emphasizes the importance of both protecting remnant natural areas and actively reintroducing native vegetation to restore ecological function.

The literature further stresses the importance of specific plant species in supporting wider ecosystem dynamics. Plants labeled “keystone” plant species constitute essential parts of ecological systems because they support a disproportionately large number of insect species, which form the foundation of many food webs (Narango et al., 2020). As primary consumers, these insects transfer energy to higher trophic levels, including birds and other wildlife. The loss of these host plants disrupts these relationships, triggering domino effects throughout the ecosystem. Therefore, incorporating

keystone species into planting design is essential for restoring functional biodiversity and supporting resilient ecological networks.

In addition, the ecological restoration literature emphasizes the broader need to address habitat degradation caused by anthropogenic activities (Karen Holl, 2020). The literature identifies restoration as a key strategy for improving species diversity and habitat conditions in disturbed environments. Beyond ecological benefits, access to biodiverse environments has also been linked to human health outcomes. Studies have shown that increased exposure to diverse plant communities can improve human microbiomes and support immune system function, further strengthening the value of biodiversity within urban landscapes.

The evidence shows that design strategies should prioritize the intentional introduction of diverse native plant communities, structured according to site-specific environmental conditions. Because plant species are adapted to particular soil, hydrologic, and light conditions, and often occur in natural groupings, a zoning-based planting approach is appropriate. This method aligns species selection with natural conditions across the site, enabling the establishment of distinct habitat types that reflect natural patterns and support sustained resilience.

The effectiveness of this design criterion can be evaluated using the Floristic Quality Assessment, which offers a quantitative measure of environmental health based on plant community composition. The Universal Floristic Quality Assessment (FQA) Calculator provides a quantifiable method for evaluating whether a landscape design successfully meets biodiversity goals by analyzing its plant species composition. FQA relies on "coefficients of conservatism" (C values) assigned to local plant species, which range from 0 for non-native species to 10 for highly conservative species that require long-unchanged, high-quality natural habitats. By inputting a landscape design's plant inventory into the online Universal FQA Calculator, designers can generate data such as the mean C and the Floristic Quality Index (FQI). High or rising values indicate that the vegetative composition closely approximates a diverse, high-

quality natural area, signaling that the landscape successfully supports indigenous biodiversity and ecosystem health. Conversely, low or declining metric values would indicate that the landscape design relies too heavily on degradation-adapted species, suggesting that biodiversity goals are not being met and that design or management changes warrant consideration (Freyman et al., 2016). This approach assesses whether the proposed design successfully improves habitat quality and biodiversity, in accordance with the goals established in the literature.

Restore Ecological and Hydrologic Function

The second criterion the literature suggested was to restore the site's ecological and hydrologic functions. This is important because it addresses flooding and disconnection from the floodplain. The first step is to regrade the site to create a more naturalistic landscape. This involves daylighting the water flow pipe, as concrete separates the water from the soil. Then designing a channel for that water that allows it to meander and slow will give the water a chance to infiltrate the groundwater and connect with the hyporheic zone (Stonedahl et al., 2013). This also removes the grey infrastructure that often fails in floodplains, costing taxpayers money to fix it repeatedly. It also reduces the control exerted over water flow; this control often misunderstands the power of water and places people and property in danger through a false sense of security (Gies, 2022).

To restore ecological functions beyond hydrology, native plants must be placed in spaces where they will thrive. When happiest, native plants can direct water through their root systems, helping it reconnect with groundwater. Plants also help to capture the pollutants before they can flow into the natural wetland environment. As mentioned in the biodiversity section, these plants support the food web, which is part of the ecological function. The entomology and animal species that evolved alongside the native species they planted create the mosaic that helps the ecosystem thrive.

Water Quality Improvement

Improving water quality is a central design objective supported by the literature on urban stormwater systems. Stormwater runoff contains a range of pollutants beyond clean precipitation, including sediments, nutrients such as nitrogen and phosphorus, heavy metals, and polycyclic aromatic hydrocarbons (PAHs), many of which originate from impervious surfaces such as roads, rooftops, and parking areas. These pollutants are often most concentrated during the "first flush" of a storm event, when accumulated contaminants are rapidly transported into receiving waters (National Research Council, 2009). As a result, stormwater contributes to degraded water quality in streams and wetlands, leading to eutrophication, reduced dissolved oxygen levels, and increased ecological stress, which can ultimately result in the loss of aquatic life (MD DNR, n.d.)

The literature further identifies untreated stormwater runoff as a main cause of water quality impairment in urban watersheds. In the Anacostia River watershed, for example, pollutant loading has been shown to be largely attributable to runoff from impervious surfaces (Tetra Tech, 2021). These findings stress the need to intercept and treat stormwater before it enters natural systems. Wetlands, both natural and constructed, are especially effective in improving water quality by processes such as particulate matter accumulation, nutrient uptake, and microbial denitrification (Craft, 2022; Randolph, n.d.). However, natural wetlands alone may be insufficient to manage excessive pollutant loads, as their capacity can be exceeded under high runoff conditions.

Based on this evidence, the literature supports the implementation of design strategies to treat stormwater before it discharges into sensitive ecological areas. Systems such as constructed wetlands, sediment forebays, and vegetated filtration zones can be used to slow, filter, and biologically process runoff before it enters existing wetland systems. These strategies not only protect the environmental soundness of receiving environments but also enhance their ability to perform essential functions,

including water purification, habitat support, and nutrient cycling. As a result, stormwater management becomes an essential part of preserving and strengthening wetland ecosystems within urban landscapes.

The performance of these strategies can be evaluated using hydrologic modeling tools such as WinTR-55. This model uses site-specific inputs, including watershed characteristics and precipitation data, to estimate runoff volumes and flow conditions. By incorporating proposed design interventions into the model, it is possible to assess the extent to which stormwater is captured, stored, or treated on site, delivering a quantitative measure of the design's impact on water management and treatment performance.

Inspiring Stewardship

Inspiring stewardship is a critical design objective that supports the enduring success and maintenance of ecological landscapes. Research indicates that individuals who participate meaningfully with natural environments can move from passive users to active participants who share responsibility for environmental care. Through repeated interactions, users develop an emotional bond and an "ethic of care" that can motivate behaviors such as monitoring, maintenance, and participation in restoration activities (Fowler et al., 2020, p. 497). However, the literature additionally emphasizes that stewardship is not an automatic outcome of exposure to natural systems; rather, it is strongly influenced by how landscapes are viewed and understood.

Because people primarily experience environments through a "perceptible realm," ecological value may go unrecognized if landscapes appear disordered or unfamiliar (Gobster et al., 2007). As a result, the design must make ecological processes visible and legible to users. This challenge can be tackled through the concept of "cues to care," visual indicators, such as maintained edges or structured planting patterns, that communicate intentionality and ongoing stewardship (Nassauer, 1995). In addition to visual strategies, educational interventions serve an important function in shaping public

understanding. Interpretive elements can reveal the ecological function of landscapes that may otherwise appear unremarkable, aligning aesthetic perception alongside ecological performance (Gobster et al., 2007). Together, these approaches foster a sense of accountability and stewardship among users, helping to support collaborative stewardship efforts that improve ecological resilience and address wider environmental challenges, such as biodiversity loss and climate change (Fowler et al., 2020).

These results indicate that design strategies should include components that both communicate ecological intent and actively engage users in the landscape. Educational signage can explain ecological processes on-site, such as stormwater treatment, habitat restoration, and plant community function, while also encouraging visitors to recognize their role in these systems. By providing accessible information and strengthening the relationship between human behavior and ecological outcomes, the design can support a deeper understanding of environmental systems and promote ongoing stewardship.

Chapter 3: Methods

Mixed Methods Approach

Building upon the knowledge established in the literature review, this chapter presents the methods used to address the research question: How can landscape architecture restore ecological and hydrological functions in a disturbed urban floodplain to improve water quality, enhance biodiversity, and foster public stewardship? Key concepts from ecological restoration, urban hydrology, and landscape stewardship were synthesized and translated into the design criteria. To address the complexities of the urban floodplain site, the project uses a mixed-methods approach. The method includes systematic site analysis, criteria development, and conceptual design generation and Research Through Design (RTD), employing an iterative design process as a mode of inquiry, and finally ending with a performance-based evaluation of the proposed multi-cell wetland system using hydrologic modeling (WinTR-55/WinTR-20) and ecological assessment tools (Floristic Quality Assessment and STEPL). This approach ensures that the resulting design is grounded in empirical research and responds to the unique spatial and environmental constraints of the Hyattsville site.

Research Through Design

Research Through Design (RTD) is a methodological approach in which spatial design functions as the primary mode of inquiry. Rather than viewing design solely as a final product, RTD treats the design process as an exploratory and systematic effort that generates new, "practical-productive" knowledge. In contrast to traditional scientific research, which is often focused on discovery and explanation, RTD integrates research and design to engage complex or "wicked" problems that cannot be solved through linear methods alone. Within this system, knowledge is produced through the exploration

and visualization of spatial possibilities, including the development of alternative concepts, mapping strategies, and design scenarios (Nijhuis & de Vries, 2019).

Design as Ecological Inquiry

Landscape architects engage in RTD through a reflexive and iterative process grounded in abduction, in which ideas are generated and evaluated simultaneously. This process occurs through three interconnected phases: analysis, synthesis, and evaluation. During the analysis phase, information is collected and interpreted to understand site conditions and identify opportunities. In the synthesis phase, these insights are translated into preliminary design proposals, which are refined into more developed spatial strategies. Finally, in the evaluation phase, these proposals are assessed against project goals, leading to further refinement or the development of alternative solutions. In this process, analytical and design thinking work together as data is translated into knowledge and then into spatial interventions. Visual representations such as maps, cross-sections, and models are used to test ideas, receive feedback, and guide iterative decision-making.

Within landscape architecture, RTD also functions as a method of ecological inquiry. Design is used to investigate natural systems such as hydrology, soil systems, vegetation, and habitat dynamics, and to evaluate how spatial interventions influence these systems. By testing different spatial configurations and programmatic elements, designers can assess ecological performance and investigate how design decisions affect environmental outcomes. Program-focused approaches also allow testing of ecological criteria, such as habitat size, connectivity, and corridor dimensions, ensuring that design proposals align with ecological objectives (Nijhuis & de Vries, 2019).

In this context, design plays an integral role in ecological restoration by guiding the transformation of existing site conditions into more functional and sustainable systems. Through iterative testing and evaluation, design interventions can support biodiversity, improve ecological processes, and enhance climate resilience. Spatial strategies, such as ecological zones or wetland systems, can be developed and refined through this process, with their performance assessed to ensure they contribute to long-term environmental goals.

Iterative Research and Design

In the process of researching this thesis, several methods were used. The methods used for this thesis were research through design using literature review, site analysis, criteria development, and concept design.

As the project was first brought to the author by a community resident, the initial research proposal was for an ecological restoration project that addressed the community's concerns about urban flooding. Therefore, one of the first steps in the method was to research the literature on ecological restoration to determine the feasibility of applying that practice to the site. This was followed by research into stormwater management in urban areas and whether these two purposes could be combined in a single small site. This became an iterative process as more information was learned through site analysis. As topics arose during site inventory and analysis, additional research became necessary. The literature provided a foundation for developing a set of design criteria.

Chapter 4: Site Analysis

Understanding the Site

Site analysis fundamentally shapes design by methodically evaluating a location's unique physical, biological, and cultural attributes to determine its overall suitability for specific land uses. By synthesizing a site's existing assets and liabilities into clear opportunities and constraints, the analysis guides context-sensitive decisions about exactly where to build and where to avoid building. This evaluative process helps designers respect a site's carrying capacity and inherent environmental constraints, ultimately minimizing negative ecological impacts, protecting vital cultural resources, and even reducing construction costs. Furthermore, insights from site analysis directly inform the conceptual design phase, ensuring the proposed project program is well adapted to the landscape's unique spatial and environmental features. Ultimately, without this complete understanding, poor site planning risks unintended consequences like environmental pollution or human exposure to natural hazards, whereas a thorough analysis maximizes the built environment's social, economic, and environmental value. Site analysis is the key step that essentially shapes the entire design process. It includes a systematic evaluation of a location's distinctive physical, biological, and cultural characteristics to determine its suitability for specific land uses.

This process is important because it synthesizes a site's existing assets and liabilities into clear opportunities and constraints, which directly inform context-sensitive decisions about development, specifically, where to build and where to avoid building. By helping designers respect a site's carrying capacity and environmental constraints, a thorough analysis minimizes negative ecological impacts, protects vital cultural resources, and can even reduce construction costs.

Ultimately, the knowledge acquired directly guides the conceptual design, guaranteeing the proposed project program is successfully adapted to the unique spatial and environmental features of the landscape. In contrast to poor site planning, which risks unintended consequences like environmental

pollution or human exposure to natural hazards, a comprehensive site analysis maximizes the built environment's social, economic, and environmental value (LaGro, 2013).

Regional Context

The project site is located in Hyattsville, Maryland. Hyattsville is located just outside Washington, D.C., immediately northeast of Driskell Park, and within the floodplain of the Northwest Branch of the Anacostia River.

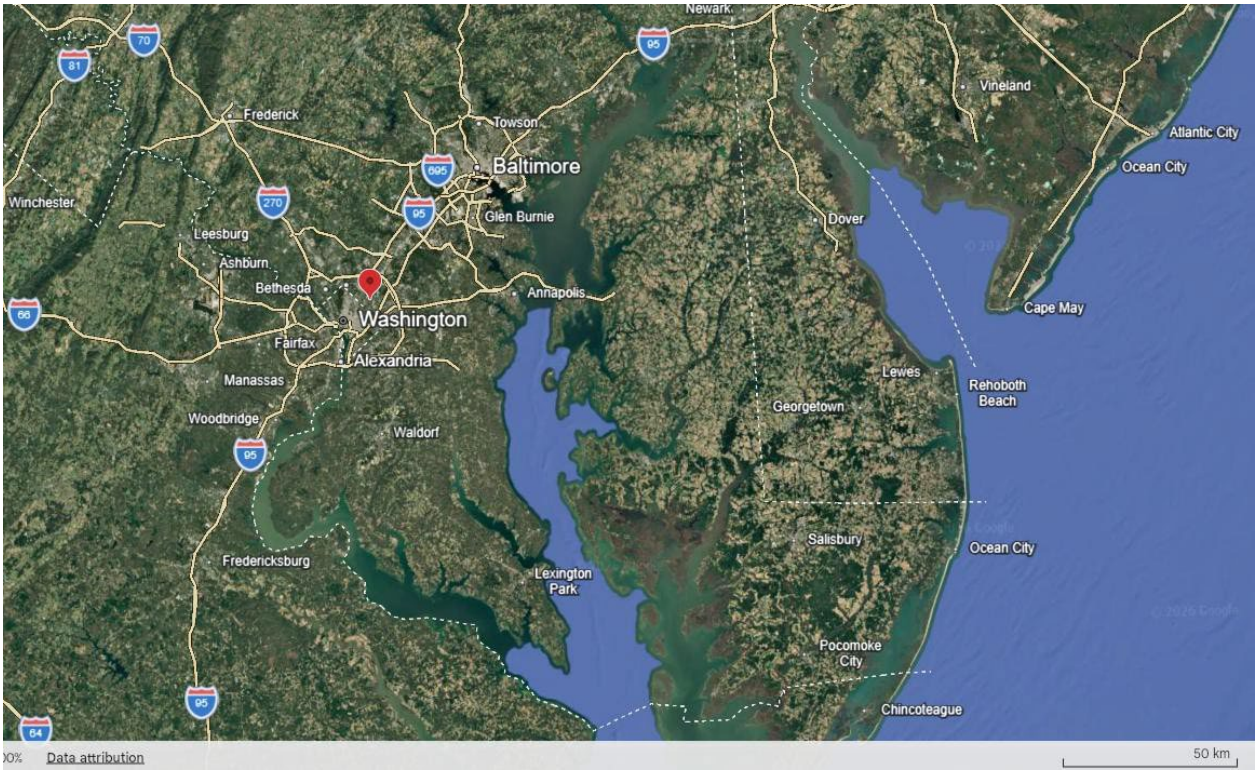

Figure 2 The site, marked by the red indicator, is located just North of Washington DC. (Google, 2026)

Regional Watershed

The site is located along the Northwest Branch of the Anacostia River. Specifically, this site is located near the confluence of the Northeast and Northwest Branches of the Anacostia, where they join to form a single channel before heading south through Washington, D.C., and then joining the Potomac River. The Potomac River then joins the Chesapeake Bay. The headwaters of the Northwest Branch extend north into Montgomery County. The watershed is predominantly impervious and urbanized, as

shown in the map below. The orange polygons represent the impervious surface within the watershed (blue boundary). The red marker shows the site location.

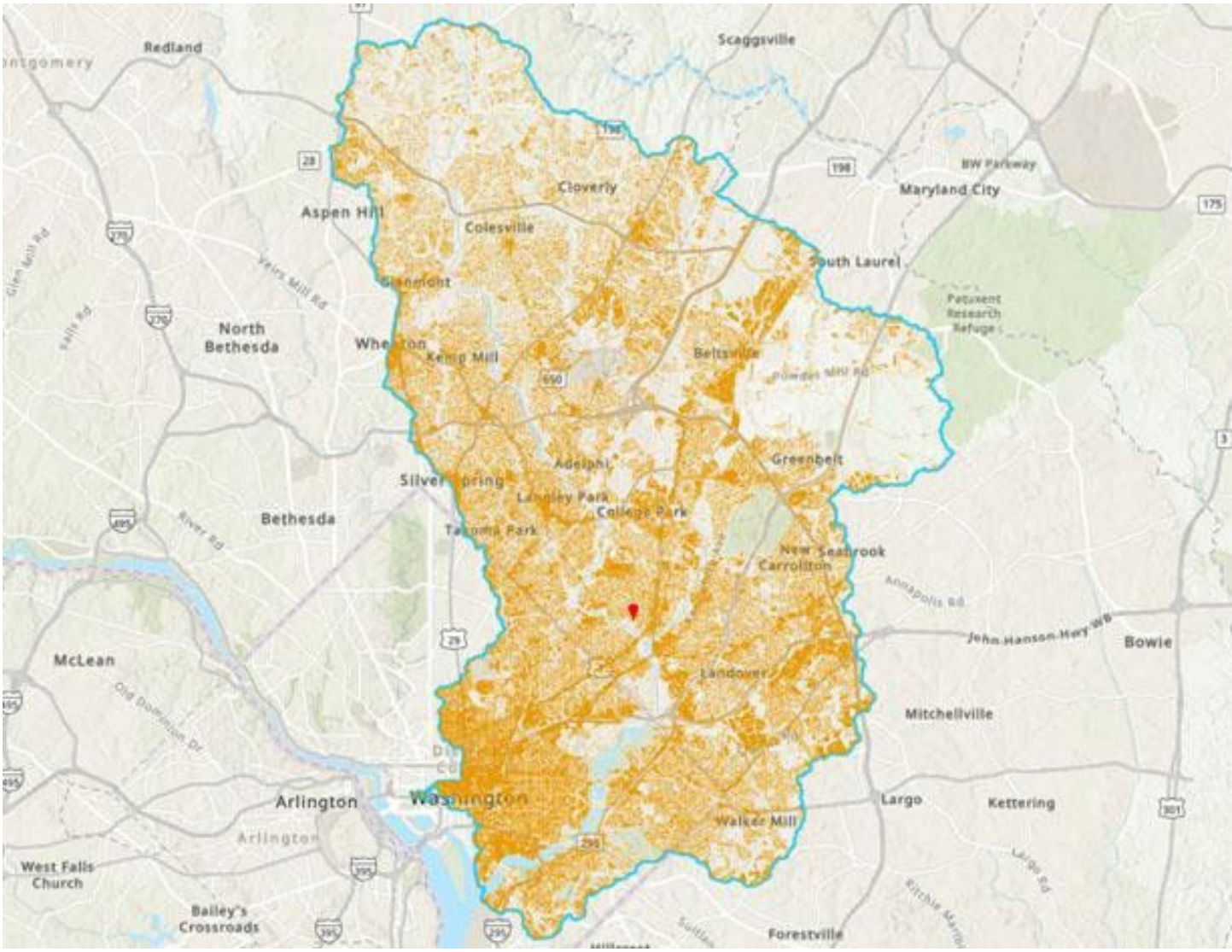

Figure 3 The site, marked in red, is located within the Anacostia Watershed, a predominantly urbanized and impervious area. (ArcGIS, 2025)

Drainage Watershed

The site drainage watershed is the area where stormwater runoff originates from before flowing into the site. This was mapped based on slope data, indicating how water flows from the neighborhood to the north into the site. A residential community surrounds the site. There are two apartment complexes

within a short walk; however, the majority of the adjacent area consists of residential lots with single-family homes. The site is deeply integrated into a mature residential fabric, denoting a close relationship with the surrounding community. Immediate proximity is defined by a mix of housing types, though single-family homes predominate. Within easy walking distance, there are two multi-unit apartment complexes. However, the overwhelming majority of the adjacent geographical area is dedicated to traditional, residential development, consisting of individual lots with single-family homes.

Figure 4 The Drainage watershed,outlined in blue, shows the areas contributing runoff ot the site, outlined in red. (ArcGIS, 2026)

Figure 5 The soils consist of ChD, Christiana–Downer–Urban land complex, RuB, Russett–Christiana–Urban land complex, and Ch, Codorus-Christian-Urban land complex soils. (NRCS, 2025)

Soils in the watershed area are entirely within the hydric group D. This means that they have a much higher rate of runoff and a low chance of water infiltration. The poor soils combined with the high impervious land use cause a high rate of stormwater runoff.

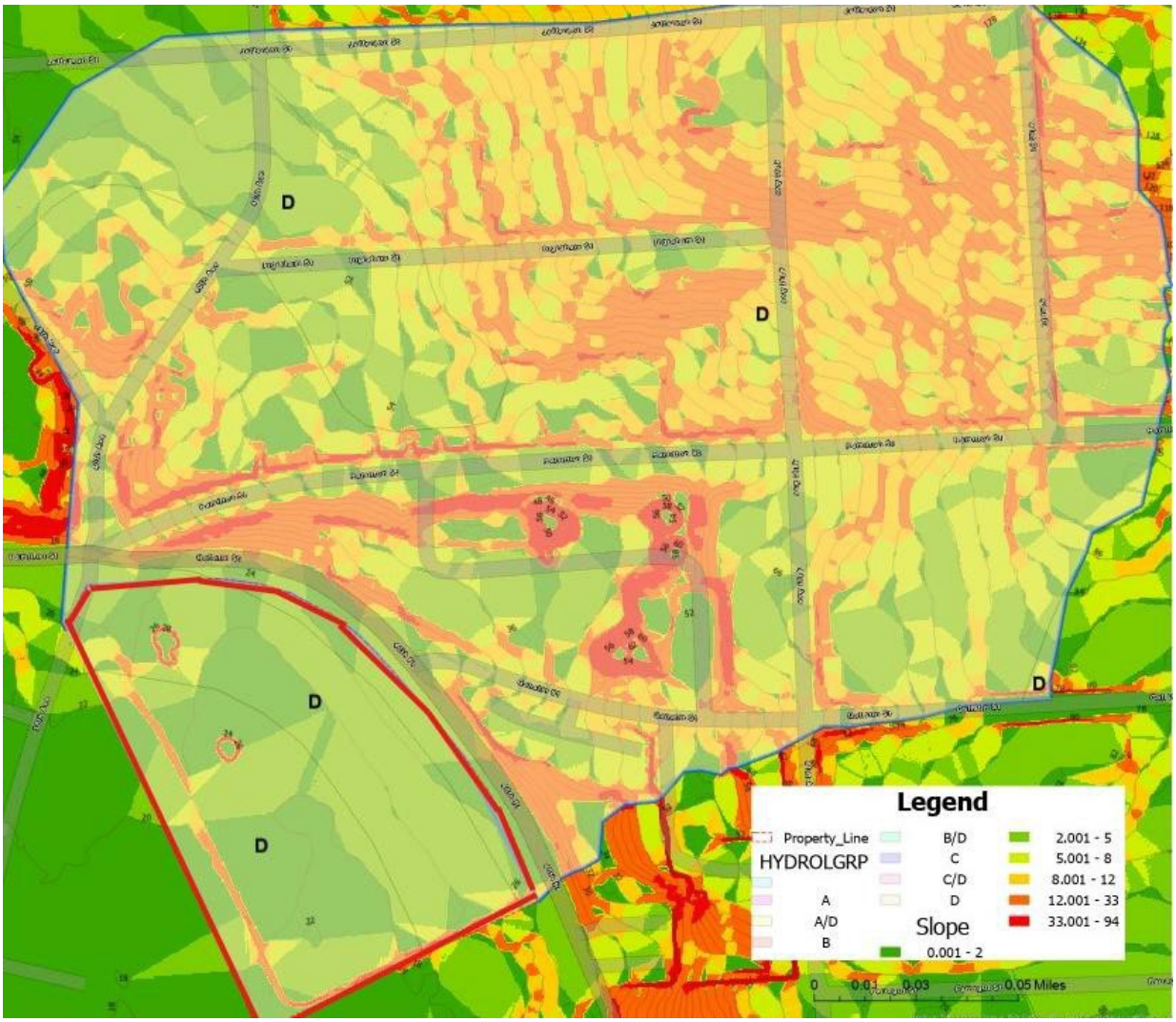

Figure 6 The drainage watershed contains entirely hydro group D soils, soils that contribute to higher stormwater runoff. The slopes are shown with red being the steepest and green being the lowest (ArcGIS, 2026).

The hydrograph below illustrates the highly impervious and rapidly responding nature of the watershed. The sharp, narrow peak indicates that rainfall is quickly converted to runoff, with minimal infiltration or storage, resulting in a high peak discharge over a short period. The steep rise and fall of the

curve further demonstrate that stormwater is conveyed efficiently through the watershed rather than absorbed or detained. This “flashy” response is characteristic of urbanized landscapes dominated by impervious surfaces such as roads and rooftops, and it underscores the need for design interventions that slow, store, and redistribute stormwater to reduce peak flows and enhance ecological function.

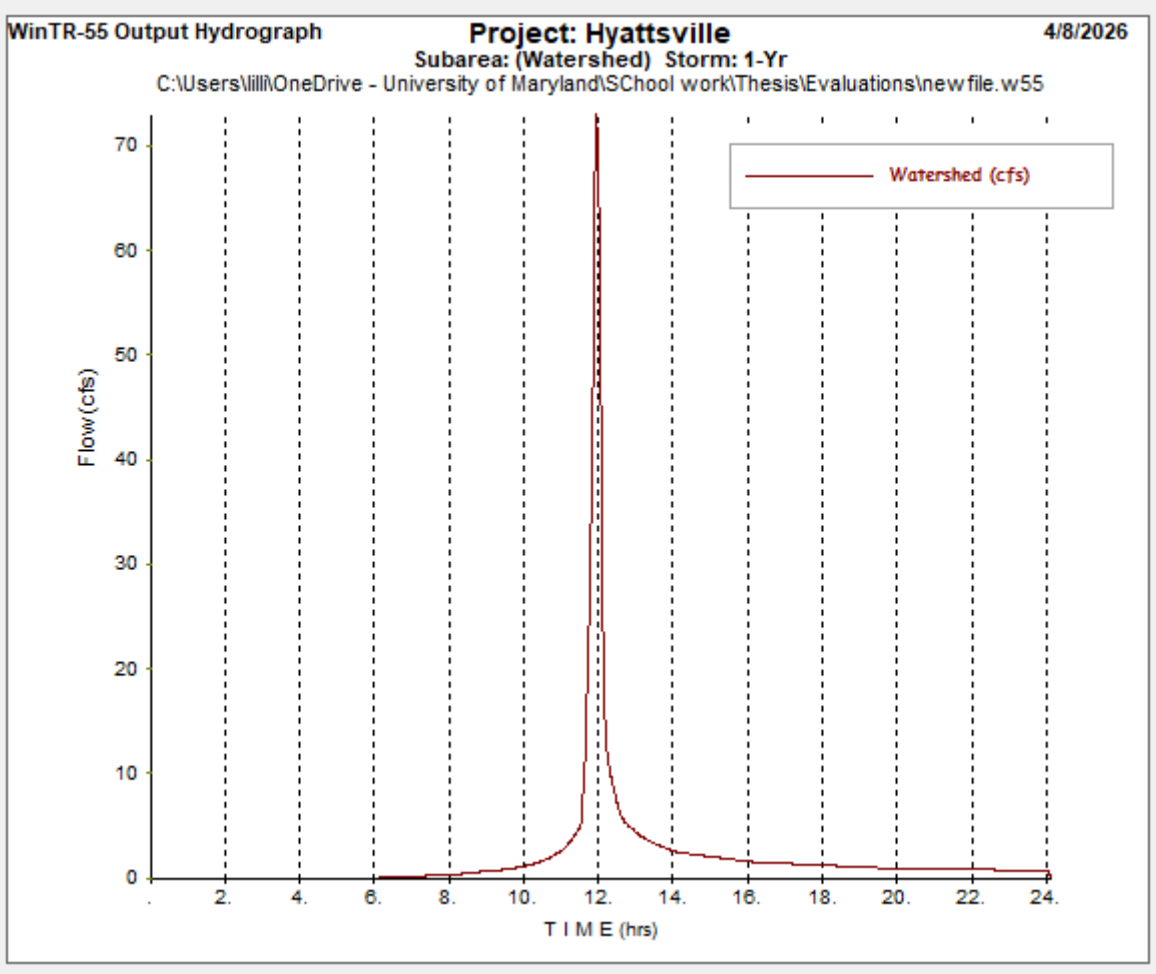

Figure 7 This hydrograph shows the rate of runoff over time. The high peak shows that the watershed has a high and fast runoff and water runs into the site at a fast pace. (WinTR-55)

Site Hydrology

A stormwater pipe runs beneath the site, conveying runoff from the adjacent urban neighborhood. A local, unsubstantiated account indicates the pipe may follow the alignment of a historic stream that was culverted, of the Anacostia River.

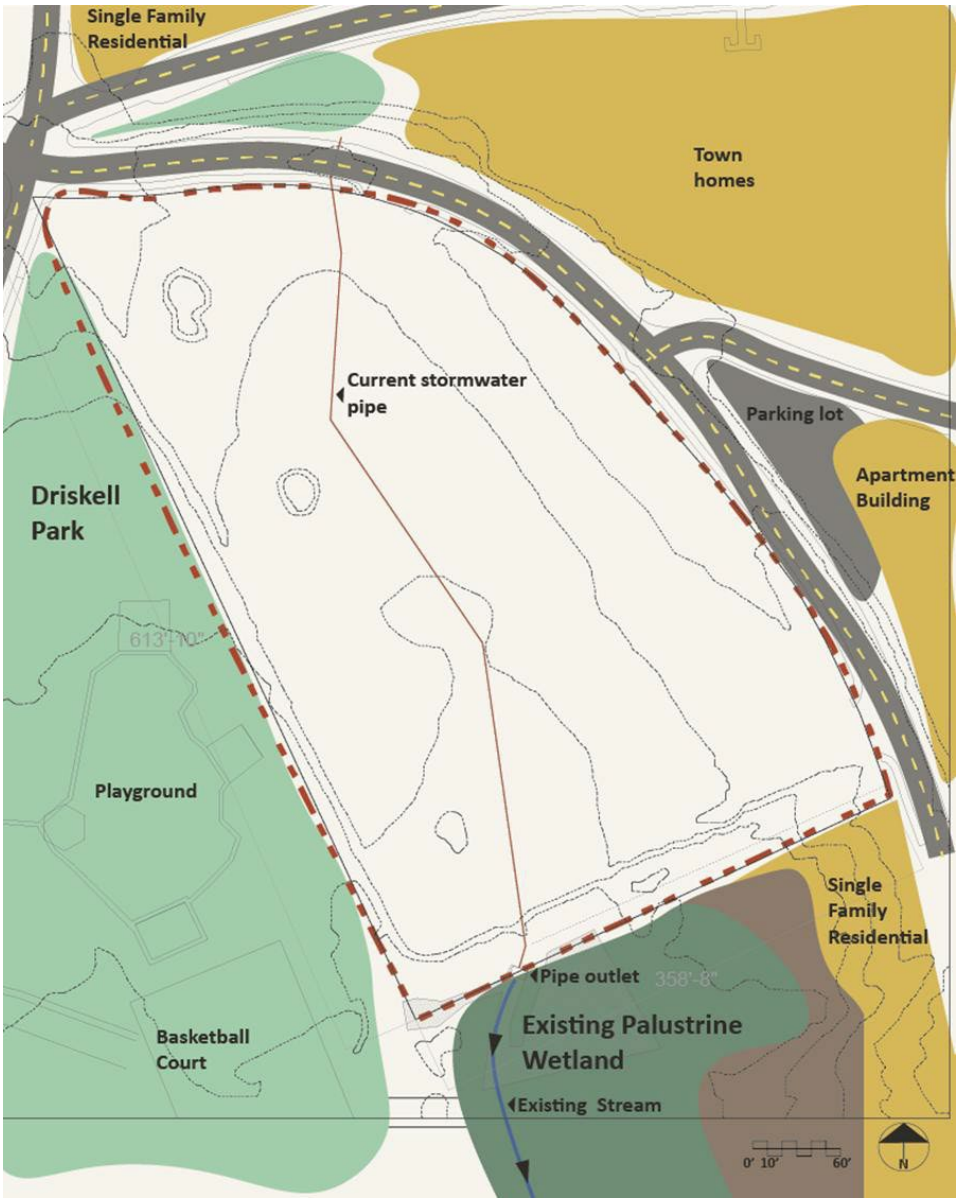

Figure 8 This site inventory diagram shows how where the stormwater pipe runs under the site and exits into the adjacent wetland.

The site is completely within the FEMA floodplain maps, as shown in the figure below. The 100-year floodplain is an area with a 1% chance of flooding per year. This is shown in dark blue and consumes the majority of the site. The 500-year floodplain is shown in light blue and covers the highest-elevation portion of the site. A 500-year floodplain is an area with a 0.2% annual chance of flood hazard.

This graphic clearly shows that this site is at risk of flooding from the Northwest Branch of the Anacostia. This suggests that any proposal for the site should be resilient to flooding.

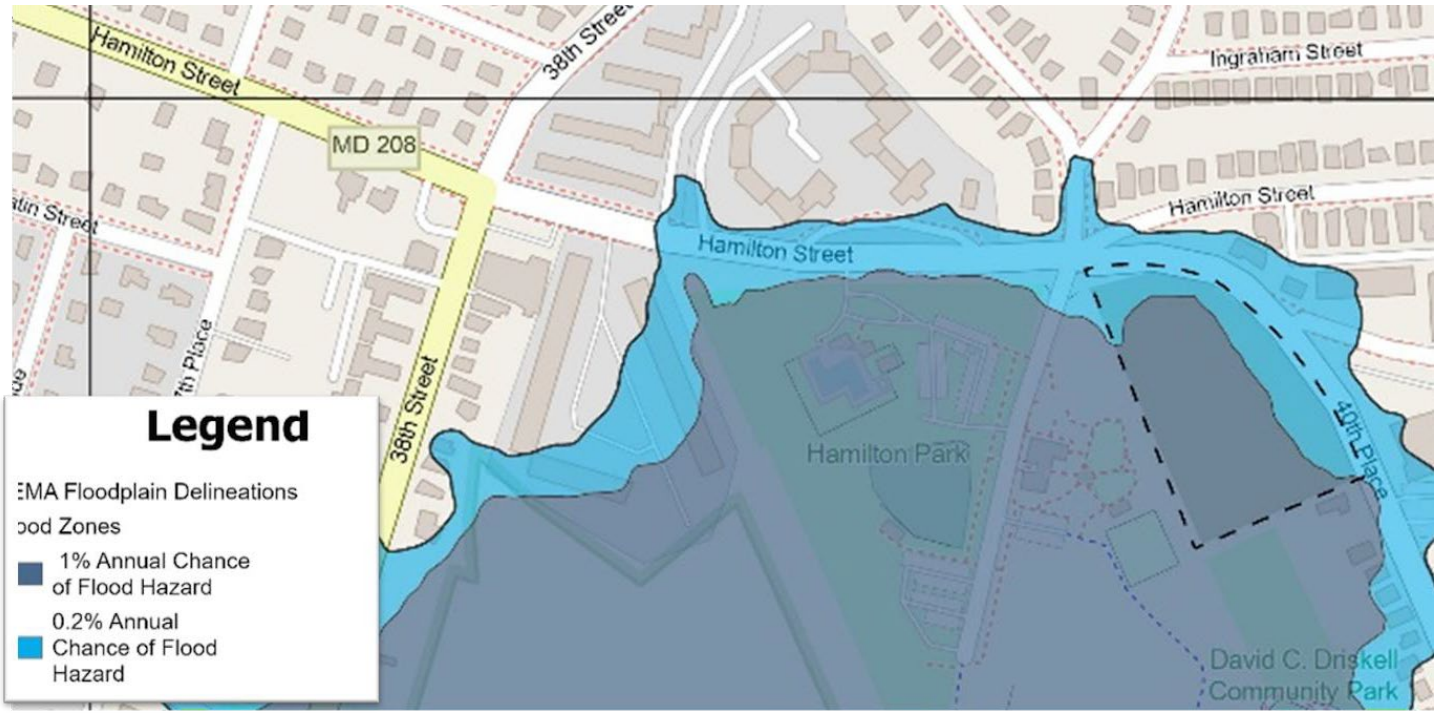

Figure 9 The FEMA floodplain map shows the site, outlined in black, sits within the 100 and 500 year floodplain. (ArcGIS, 2025)

Adjacent Wetland

The stormwater pipe under the site discharges a consistent, shallow flow at the southern edge of the site directly into an existing palustrine wetland. Water then continues southward to the Northwest Branch.

The wetland is listed in the National Wetlands Indicator under code PF01A. The code can be broken down into P for Palustrine, FO for forested, 1 for board-leaved deciduous, and A for temporarily flooded. This means that the wetland is characterized by the persistence of woody materials, particularly trees 6 meters or taller and shrubs with relatively flat leaves that fall off once cold weather sets in, and is not defined by frequent, visible surface water, but instead by periodic episodes of present surface water.

Figure 10 An existing Palustrine Wetland sits to the South of the site and receives the water from the stormwater pipe running under the site.

Site Soils

The soils within the project site reflect a heterogeneous coastal plain system, with upland, transitional, and floodplain conditions that strongly influence hydrology and ecological potential. Upland areas are primarily characterized by the Christiana–Downer–Urban land complex. Within this complex,

moderately well-drained, clay-rich Christiana soils exhibit low permeability and generate higher surface runoff, while adjacent sandy Downer soils are well-drained with high permeability but limited water-holding capacity. This combination results in variable moisture conditions across slopes (Natural Resources Conservation Service [NRCS], 2025).

In lower-gradient upland areas, the Russett–Christiana–Urban land complex provides more consistent soil conditions. These moderately well-drained loamy soils retain greater moisture and support mesic vegetation communities, although seasonal water tables remain at moderate depths (NRCS, 2025b). In contrast, the floodplain is defined by the Codorus–Hatboro–Urban land complex, where frequent flooding and shallow water tables create conditions favorable for wetland development. Hydric Hatboro soils in particular support riparian ecological functions, including water storage and nutrient processing (NRCS, 2025).

Together, these soil types form a clear hydrologic gradient from well-drained uplands to poorly drained floodplain environments. This gradient provides a firm foundation for restoration strategies that correspond to existing soil properties and support natural landscape processes.

Figure 11 The soils consist of ChD, Christiana–Downer–Urban land complex, RuB, Russett–Christiana–Urban land complex, and Ch, Codorus-Christian-Urban land complex soils. (NRCS, 2025)

Site Topography

The existing topography has been altered since the latest contours were created due to the recent construction work. For the purpose of this proposal, the available contours shall be used for research purposes. Because the site had been a parking lot, the slope is very minimal. Due to the irregular contours to the south and west that wrap directly around the site boundary and the site's history, it is

assumed that the contours are not the natural contours of the land, and grading has occurred to create an unnaturally flat surface.

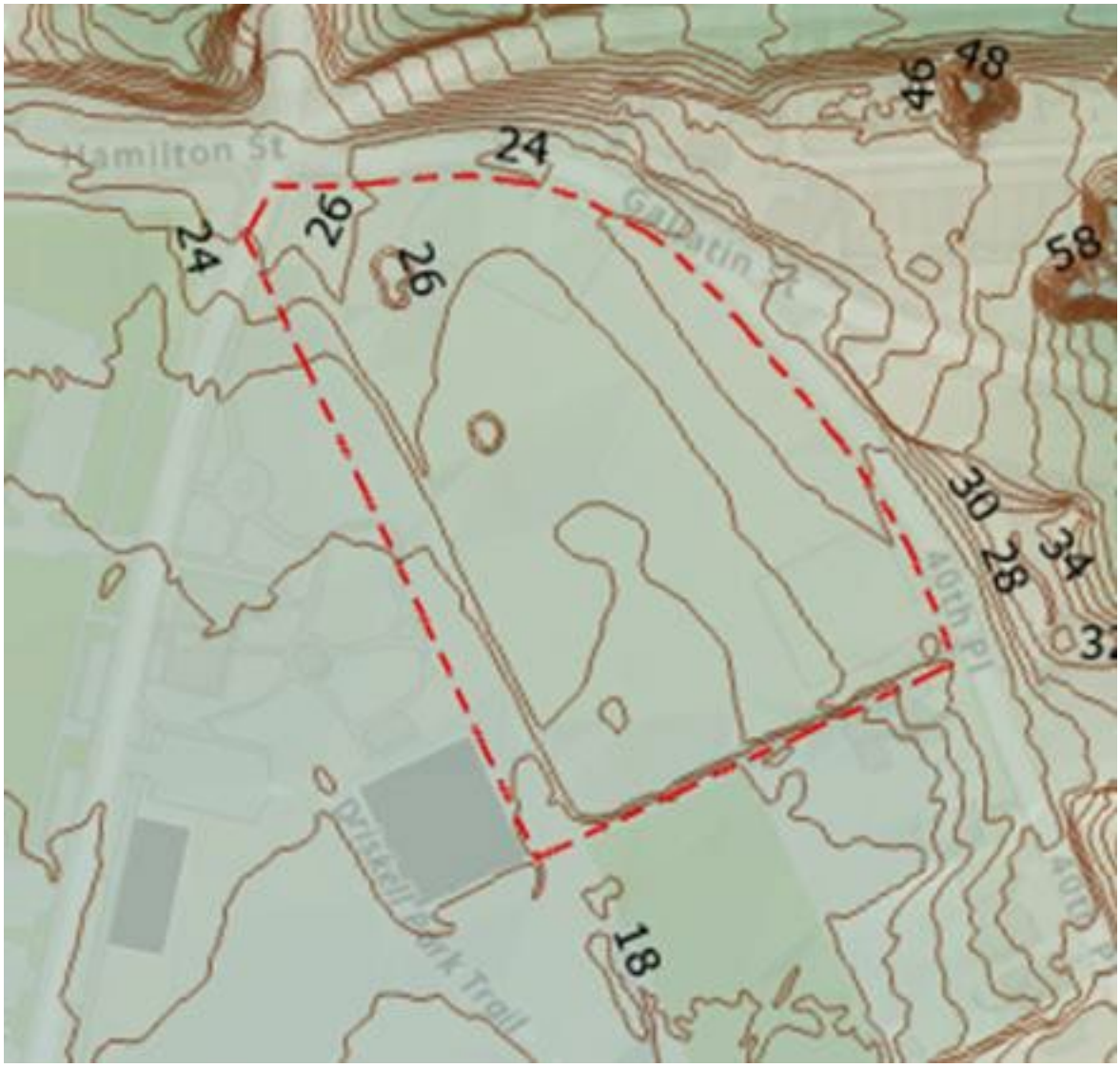

Figure 12 Site contours appear to show historical grading to flatten the land. (ArcGIS, 2025)

Figure 10

Vegetation

On-site vegetation is limited due to the site's disturbed condition. Species observed during site visits include switchgrass (*Panicum virgatum)*, Bermuda grass (*Cynodon dactylon*), common fleabane (*Erigeron philadelphicus*), American pokeweed (*Phytolacca americana*), cattails (*Typha latifolia*), Japanese stiltgrass (Microstegium vimineum), Canada goldenrod (*Solidago canadensis*), and willow species (*Salix nigra)*.

Species observed during site visits show that the wetlands are characterized by skunk cabbage (*Symplocarpus foetidus)* in the spring, spicebush (Lindera Benzoin), American Beech (*Fagus grandifolia)*, Tulip Poplar (*Liriodendron tulipifera*), and multiple native fern species, including cinnamon fern (*Osmundastrum cinnamomeum),* as well as invasive species such as Ground Ivy (Glechoma hederacea), Common Ivy (*Hedera helix)*, multiflora rose (*Rosa multiflora),* and both Japanese (*Lonicera japonica)* and Amur honeysuckle (*Lonicera maakii)*. According to reputable observations on iNaturalist, there are many more species present, including Common Paw Paw (*Asimina triloba*), Mayapple *(Podophyllum peltatum)*, Virginia Creeper (*Parthenocissus quinquefoilia)*, Sweetgum (*Liquidambar styraciflua)*, and Jack in the Pulpit (*Arisaema triphyllum)*.

The observations made in the nearby natural area exhibit plant and hydrological traits consistent with Coastal Plain Floodplain habitats, which are dynamic ecosystems associated with streams and rivers and influenced by groundwater seepage and periodic overbank flooding. These systems typically support complex, multi-layered vegetation structures, including well-drained natural levees and river terraces. In these areas, canopy species such as tulip-poplar and American beech are commonly found alongside understory species such as pawpaw and spicebush. The presence of woody vines, including Virginia creeper, and herbaceous species such as Jack-in-the-pulpit further supports this classification, as these plants are characteristic of the structurally diverse forests found within floodplain environments (Maryland Department of Natural Resources [MD DNR], 2016)

The site also shares characteristics with Mesic Mixed Hardwood Forests, which typically occur on acidic soils in moist upland settings, including lower slopes, ravines, and undulating terrain within the Coastal Plain. The dominance of American beech and tulip poplar in the canopy, combined with an understory of pawpaw, is indicative of this forest type. These mesic systems commonly occur in transitional zones where upland and wetland conditions intersect, allowing them to grade into environments such as Coastal Plain Seepage Swamps. This transition is reflected in the presence of moisture-dependent species, including skunk cabbage, cinnamon fern, and spicebush, which are associated with areas of groundwater emergence at the base of slopes (MD DNR, 2016)

The results of the site observations inform the design approach by identifying appropriate reference ecosystems and guiding plant community selection. Restoration strategies will focus on reestablishing native floodplain and mesic forest species adapted to the site's hydrologic and soil conditions, while additionally addressing invasive species pressure. Through aligning proposed plant communities with existing ecological patterns and gradients, the design promotes long-term resilience, habitat function, and environmental health.

Cultural Site History

According to local reporting, this site may have been the location of a historic ballpark that predated the city itself. That ballpark was then the gathering point for the July 31st, 1913, National American Woman Suffrage Association (NAWSA) motorcade that then proceeded down to Washington, D.C. This motorcade carried 85,000 signatures on amendment petitions for Women's right to vote (Suffrage Petitioners' Automobile Parade to the U.S. Senate, Hyattsville, MD, July 31, 1913, 2026); Times, 2018).

Figure 13 The site may have been the rallying point for the 1913 Women's Suffrage motorcade. (Records of the National Woman's Party, Manuscript Division, Library of Congress)

Chapter 5: Design

Design Overview

The design selection process was informed by established criteria identified in the literature. Of the alternatives considered, the multi-cell wetland system most effectively addressed these criteria and was selected for further development. This approach maximizes habitat and biodiversity by establishing multiple resilient native plant communities tailored to site-specific conditions and supporting diverse wildlife species. The introduction of various habitat types, including wetlands, wet meadows, upland meadows, and forested zones, increases the number of ecotones, which are recognized as areas of heightened biodiversity. The use of multiple wetland cells further enhances habitat complexity and ecological value.

The design restores ecological and hydrological functions by enabling water to slow, spread, and infiltrate throughout the site. The removal of the existing stormwater pipe reconnects surface flows with the ground, facilitating natural hydrologic processes. Grading strategies emulate natural landforms, reduce reliance on fill, and support water movement consistent with existing landscape dynamics. Native plant communities, selected for compatibility with soil and hydrologic conditions, contribute to water filtration, nutrient uptake, and long-term soil improvement. As these systems mature, they are anticipated to enhance microbial activity and provide habitat and food sources for fauna, thereby reinforcing ecological resilience.

Conceptual Design

Concept 1: Daylighted Channel

The first concept proposes regrading the site to remove the existing stormwater pipe and allow water to flow freely through an open channel that traverses the site before discharging into the natural

area to the south. The planting strategy includes a narrow band of wet meadow species along the channel edge, small patches of wet and upland forest species adjacent to the southern forest, and a dominant upland meadow across the majority of the site. A buffer of streetscape planting is maintained along the site's perimeter to provide continuity with surrounding infrastructure.

This concept was explored as the most straightforward and minimally interventionist approach supported by the literature. In its existing condition, stormwater is conveyed rapidly through a pipe, bypassing opportunities for infiltration and filtration and transporting untreated runoff directly into the adjacent natural wetland system. By daylighting the channel, water movement is slowed, allowing limited infiltration and initial nutrient filtration before entering the downstream environment.

While this approach offers advantages in terms of simplicity and reduced grading requirements, it provides only a limited ecological benefit compared to more complex systems. Habitat diversity remains low, as the site is largely dominated by upland meadow conditions with only small areas of additional habitat types. The channel lacks sufficient space to expand during high precipitation events, increasing the potential for erosion. Additionally, the absence of ponding or wetland conditions limits opportunities for groundwater interaction and pollutant removal. Sediment transport remains largely unmitigated, as there is no dedicated settling area, and the transition from pipe to exposed soil may increase sediment movement off-site.

This concept highlights the trade-offs inherent in restoration design, particularly the balance between cost and ecological performance. While it represents a relatively low-disturbance intervention that improves upon existing conditions, it demonstrates that minimal intervention does not necessarily achieve optimal ecological outcomes.

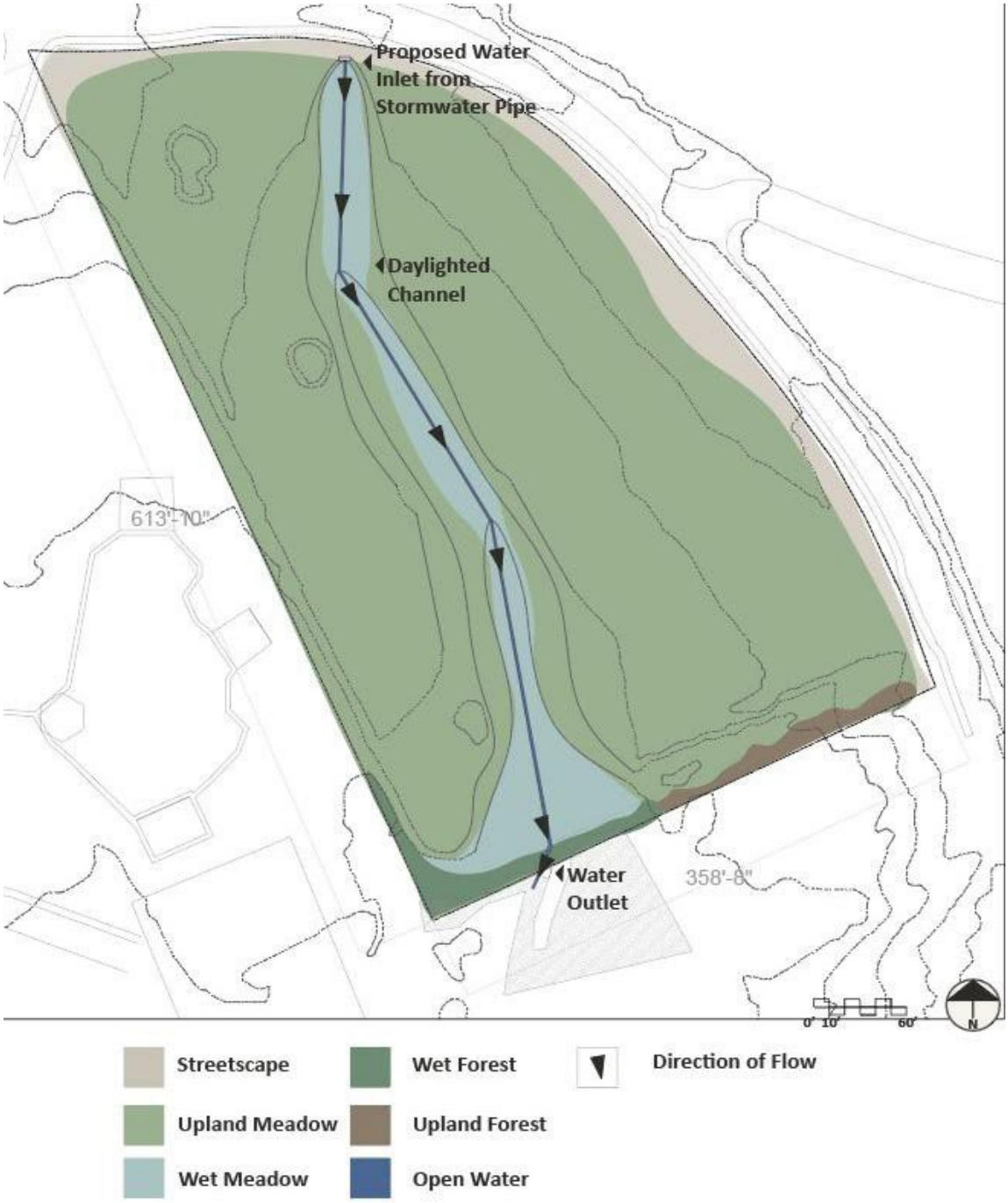

Figure 14 Concept 1 is a simple daylighting of the stormwater flow.

Concept 2: Sediment Catchment Pond

The second concept builds upon the first by removing the stormwater pipe and introducing a regraded central depression that allows water to pond before flowing into the adjacent forested area. While the streetscape planting remains consistent, the extent of wetland meadow increases, and the ponding area supports a greater presence of aquatic vegetation.

This concept was developed to improve water quality and ecological function by introducing a centralized area for sediment capture and increased infiltration. The pond allows suspended sediments to settle out of the water column before discharge, thereby reducing pollutant transport into downstream systems. In addition, the presence of standing water creates opportunities for aquatic plant communities, such as water lilies and arrow arum, and enhances habitat conditions for species that depend on ponded environments.

Compared to the first concept, this approach significantly improves habitat diversity by incorporating both aquatic and terrestrial systems and expanding wetland conditions across the site. However, these benefits are accompanied by notable limitations. The creation of a large central pond requires extensive regrading, increasing construction costs, and causing greater ecological disturbance during construction. Furthermore, the pond introduces challenges for site circulation, as it creates a physical barrier between the eastern and western portions of the site. This would necessitate either substantial bridging infrastructure or rerouting circulation paths around the pond.

This concept demonstrates that while ponding can improve sediment capture and habitat diversity, concentrating water in a single location may introduce spatial and functional constraints. It suggests that distributing water treatment processes across the landscape may achieve similar ecological benefits while maintaining site connectivity and reducing construction impacts.

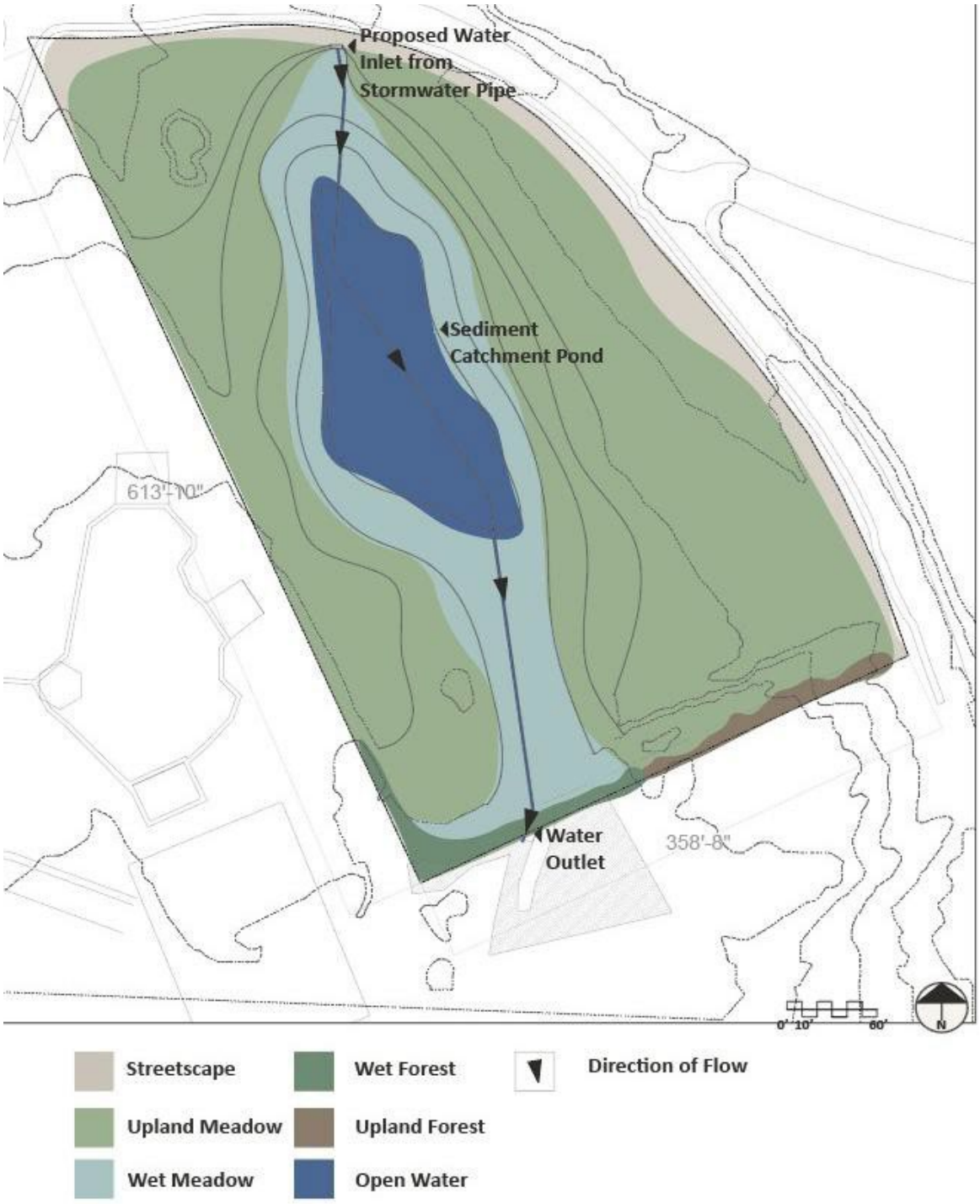

Figure 15 Concept 2 is a large sediment catchment pond.

Concept 3: Multi-cell Wetland System

The third concept expands upon the previous approaches by introducing a distributed, multi-cell wetland system. As in the prior concepts, the stormwater pipe was removed, and the water flow is daylighted; however, instead of a single channel or pond, the design incorporates three distinct treatment zones. The first cell functions as a sediment forebay, capturing debris and coarse materials as water enters the system. The second cell serves as the primary treatment wetland, providing extended retention time for sedimentation, filtration, and nutrient uptake. The third cell acts as a polishing wetland, offering final filtration before water exits the site and enters the adjacent forest.

This configuration allows for a greater representation of wetland plant communities while maintaining areas of upland meadow. Additionally, the southern portion of the site is designed as an expanded forested zone, creating a transition between the restored system and the existing natural landscape.

This concept was developed to integrate the benefits of ponding with a distributed system that enhances ecological performance and spatial connectivity. By dividing the treatment process into multiple stages, water is progressively slowed, enabling improved sediment capture, nutrient removal, and infiltration. The distributed nature of the system also supports greater habitat diversity, creating a mosaic of ecological conditions rather than a single dominant type.

Among the three concepts, this approach provides the highest level of ecological function. The sediment forebay simplifies maintenance and protects downstream systems, while the primary and secondary wetland cells support key ecological processes and habitat development. The design also improves circulation by allowing smaller, strategically placed crossings, such as boardwalks, rather than requiring large bridges. Additionally, grading is more evenly distributed across the site, reducing the intensity of disturbance compared to a single large excavation.

Despite these advantages, the system introduces increased complexity in both design and

implementation. The coordination of multiple wetland cells requires careful grading and hydraulic planning to ensure proper flow between components. Maintenance requirements may also be less intuitive, necessitating clear management strategies for sediment removal and vegetation care. Because system performance depends on the interaction of multiple elements, ongoing monitoring may be required to ensure effectiveness.

This concept demonstrates the importance of working with natural processes rather than relying on a single engineered solution. By functioning as an interconnected ecological network, the multi-cell system integrates sediment capture, water filtration, habitat creation, and human access. It also highlights the need for a deeper understanding of hydrology, plant communities, and system performance when designing complex restoration strategies.

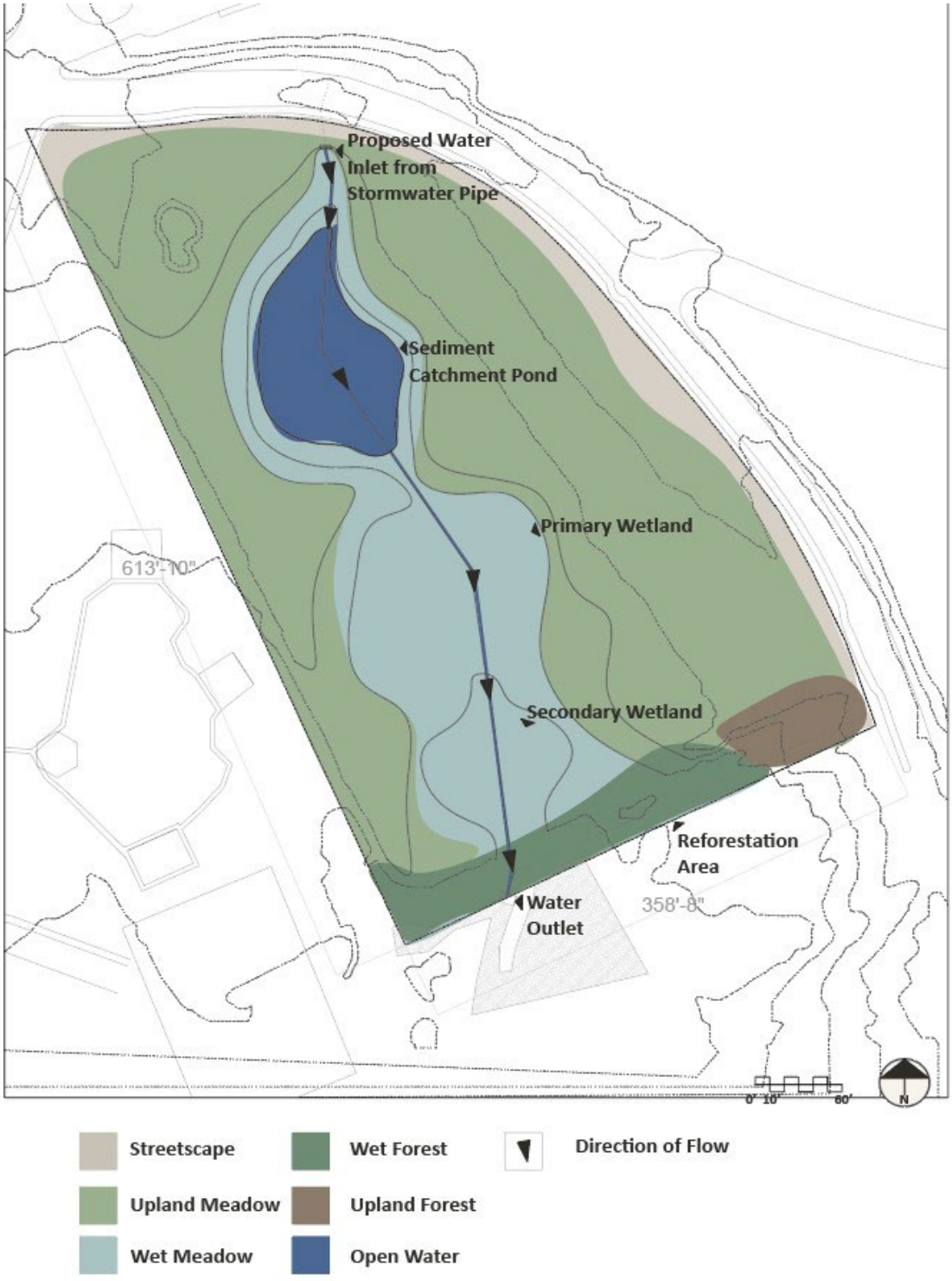

Figure 16 Concept 3 is a multi-cell system containing a sediment pond and two wetland cells.

The multi-cell system provides comprehensive water quality treatment by reducing sediment and nutrient loads prior to discharge into downstream wetlands. The sediment forebay slows water, allowing suspended sediments to settle. Subsequently, water enters the primary wetland cell, where extended residence time, slow flow, and increased surface area promote infiltration and filtration. Soil and plant roots filter sediments and limit erosion, while vegetation absorbs excess nutrients. The final wetland cell further improves water quality before discharge. Collectively, these processes protect downstream ecosystems and enhance water conditions throughout the watershed.

The design promotes stewardship by facilitating public engagement and education. Features such as overlook bridges allow visitors to experience the landscape and observe ecological processes directly. The presence of diverse plant and animal life encourages exploration and environmental awareness. Interpretive signage communicates the functions and values of the wetland systems. These elements foster visitor understanding of their ecological role and encourage responsible environmental behaviors. Zoned planting strategies support manageable maintenance and align stewardship with practical site management. The preservation and enhancement of natural wetlands, along with improved water quality for the Anacostia River, contribute to both local and regional ecological health.

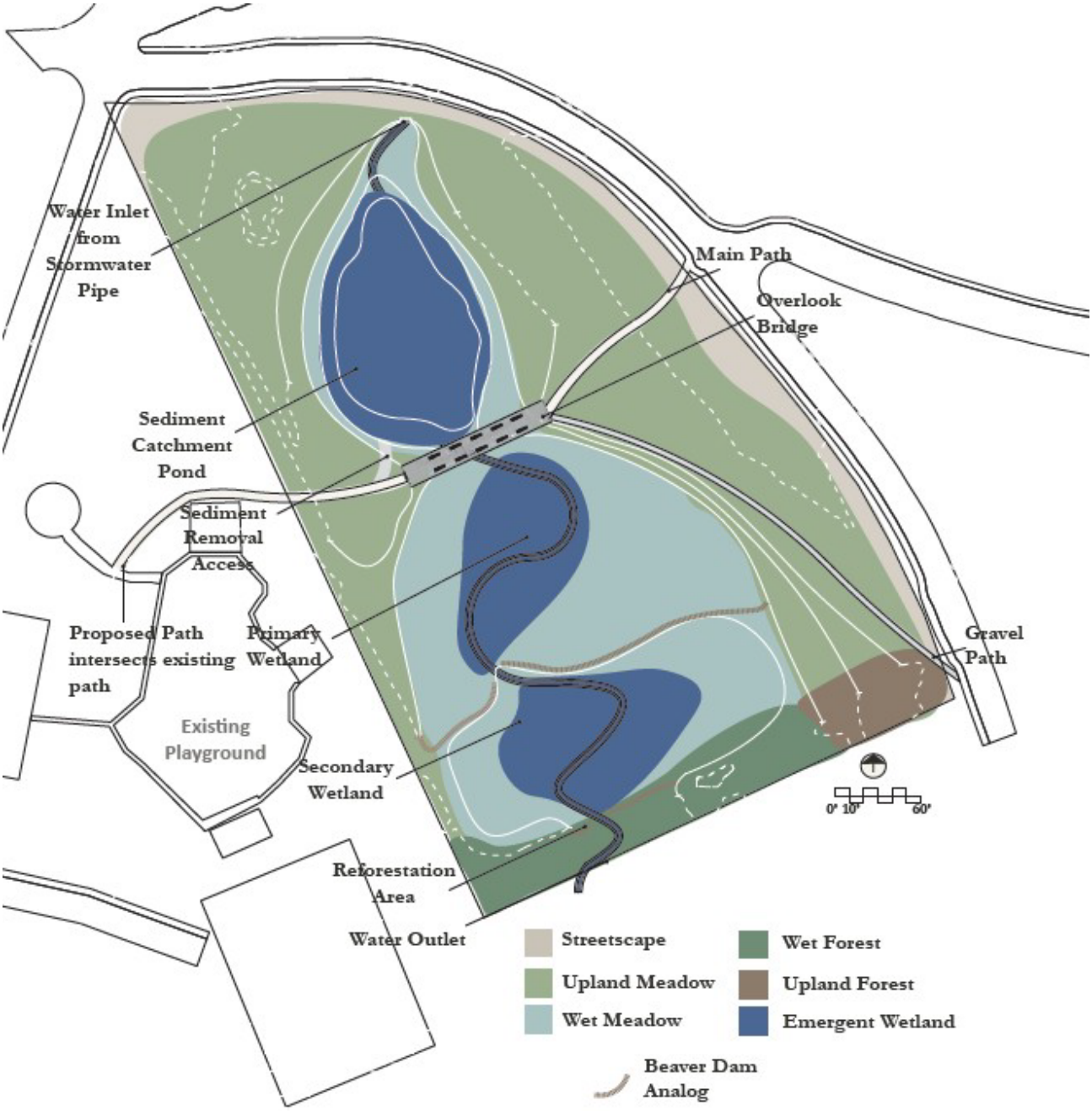

Figure 17 Diagrammatic Design Plan

Hydrologic Function

Stormwater flow is removed from the existing underground pipe and reintroduced to the surface

in the proposed design. A daylighted channel meanders southward to reconnect with the existing open channel to the wetlands. Near the site's upstream portion, grading creates a catchment pond as the first treatment feature. This pond slows incoming flows and allows suspended sediments and solid pollutants to settle before the water moves through the system.

Regenerative Stream Conveyance

The channel design employs the Regenerative Stream Conveyance (RSC) concept, a method for reversing ecosystem degradation by reconnecting streams to their native floodplains. This is accomplished by constructing a graded sequence of pools and berms that slow, retain, and disperse streamflow. Rather than using traditional impervious aggregates for construction access, RSC utilizes a porous sand and woodchip filter bed. This filter bed serves as a low-impact, in-stream haul road during construction and remains in place to promote vertical water infiltration and provide an organic carbon source for ecological processes (*Regenerative Stream Conveyance: Construction Guidance*, 2018).

Downstream of the catchment pond, the graded landscape forms a broad, flat area beside the channel. This area lets water spread, creating wetlands that reconnect surface water with the floodplain, groundwater, and plant communities. These wetlands support natural hydrologic and ecological processes. As water passes through, soils and plants filter out excess nutrients and pollutants.

Beaver Dam Analog

A barrier or weir is required to slow water and facilitate infiltration. This proposal utilizes a Beaver Dam Analog (BDA) to achieve these hydrologic objectives. By reducing stream velocity, BDAs increase subsurface water storage in the hyporheic zone, elevate the local water table, and promote the establishment of robust riparian vegetation. The structures are constructed by driving wooden posts into the channel substrate to form a stable framework, with locally sourced brush such as willow and red osier dogwood hand-woven between the posts. This low-tech approach enables community volunteer participation in construction. The design minimizes the need for concrete structures and employs natural

materials to replicate the hydrologic functions of beavers. Unlike static concrete weirs, the BDA matrix maintains structural porosity for ecological connectivity and fish passage, and can be readily adapted over time by adjusting the weave to accommodate changing geomorphic conditions (Pollock et al., 2014).

This treatment and reconnection sequence improves water quality before discharge. Water leaving the site has lower sediment and nutrient loads. This minimizes negative impacts on nearby natural wetlands and supports their ecological health and resilience.

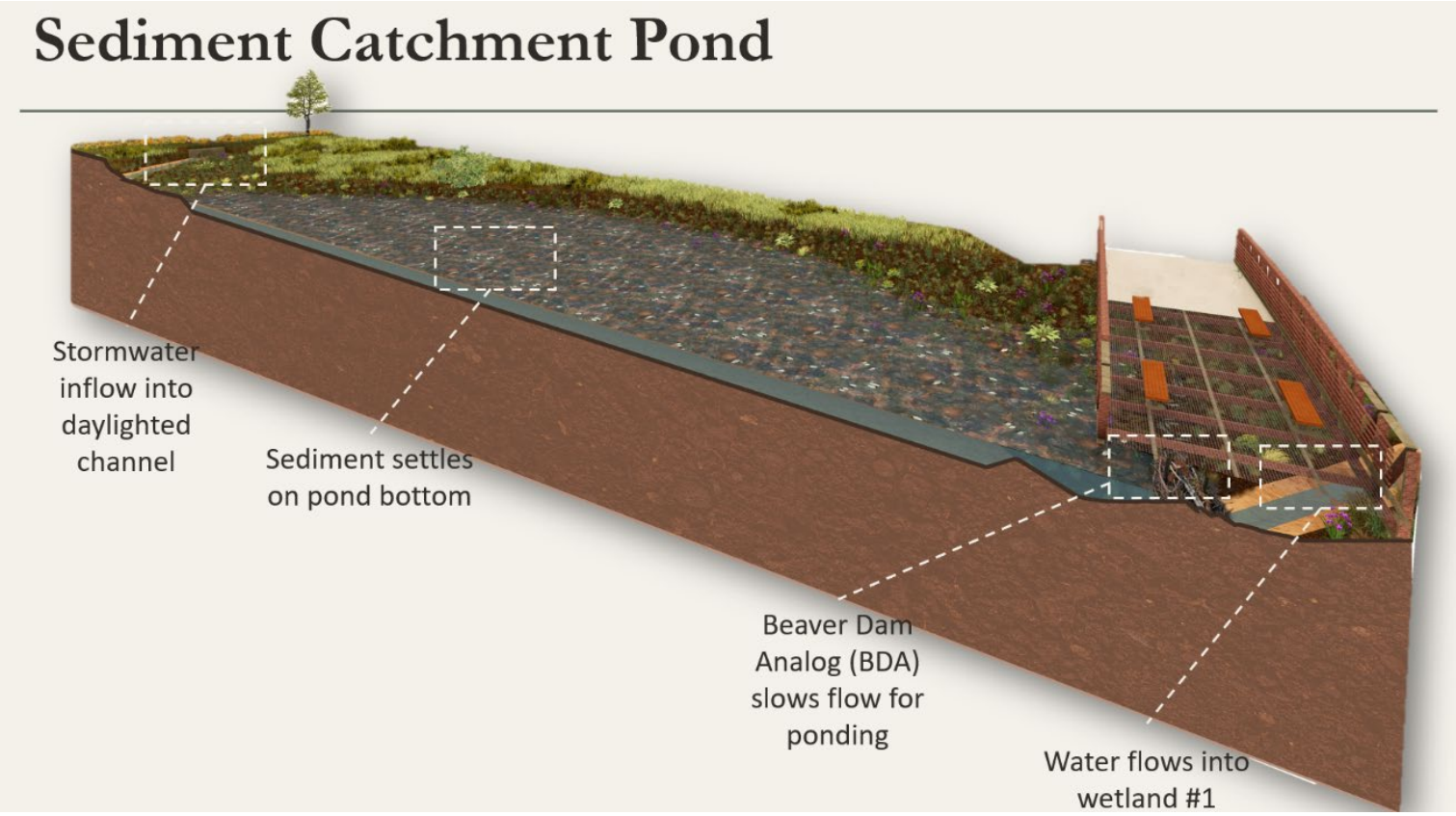

Figure 18 Section cut showing the first cell of the proposed design.

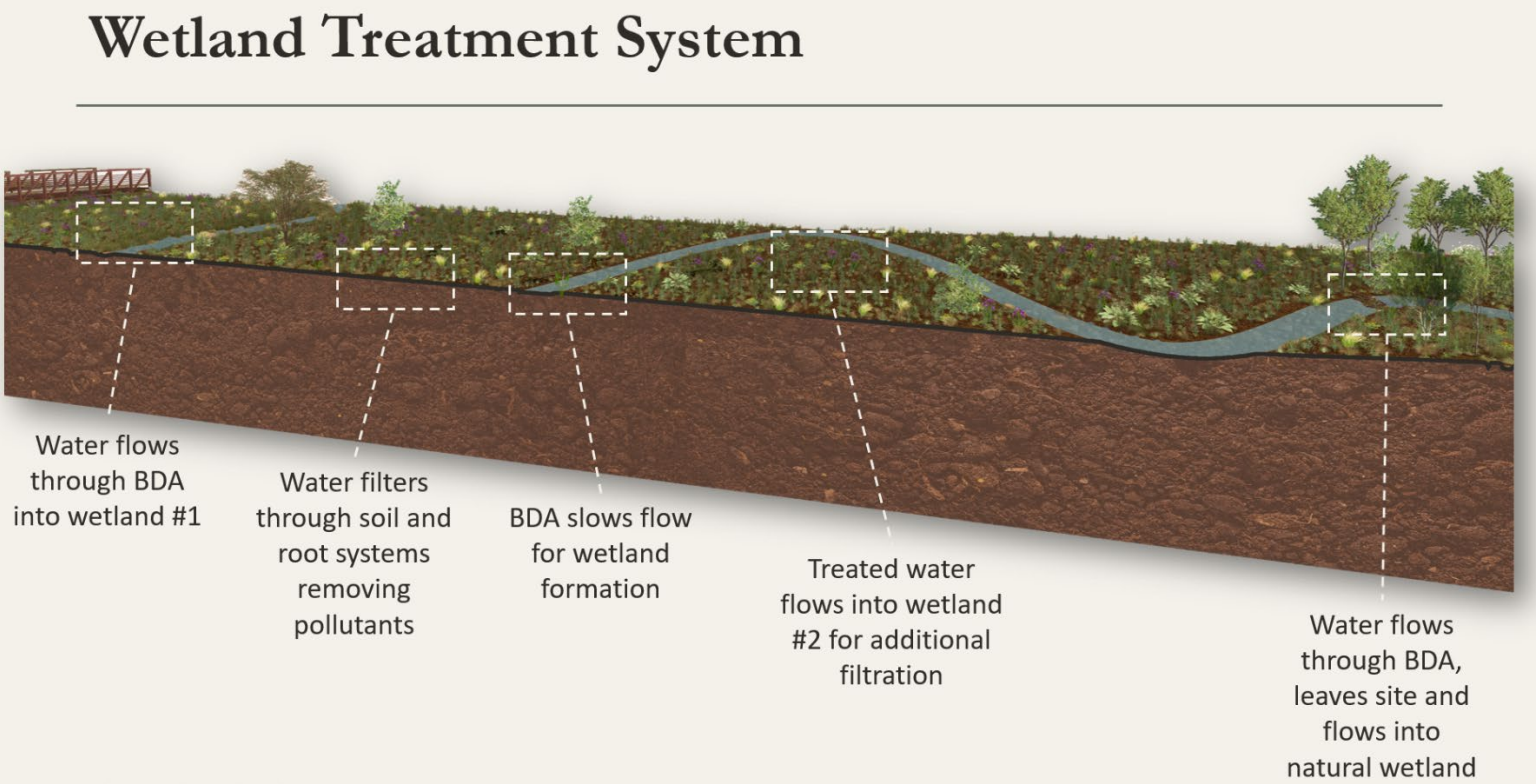

Figure 19 Section cut showing the wetland treatment portions of the proposed design.

Planting and Habitat Zones

Plant selection was informed by literature and tailored to meet project criteria under both existing and proposed restoration conditions. The digital ecosystems guide from NatureServe and the Maryland Key Wildlife Habitats chapter informed the identification of suitable plant communities, considering the site's location within the coastal plains ecoregion and the composition of adjacent natural areas. The *Maryland Native Plant Guide: Piedmont Region* was used to check commercial availability of species and choose species for the novel ecosystems like the streetscape and the upland successional meadow. Although the site currently receives full sun, the design anticipates ecological succession, aiming for eventual reforestation. Multiple planting zones are proposed to address the site's varied conditions. Species were selected to promote pollination, habitat creation, and the return of seed-dispersing fauna.

Each zone incorporates keystone species to attract lepidoptera and birds, supporting site biodiversity.

Figure 20 Each color represents a different planting condition and group of proposed plants to suit the condition.

The first zone is the streetscape planting. The plants here were chosen for their durability in novel conditions, not to mimic any ecological system. This area acts as a buffer from the road for the ecological restoration zones. Though not a restored habitat, this zone still increases biodiversity by using native species. It needs plants that can survive road salt, heat, and frequent disturbances. Species such as Pin Oak (*Quercus palustris*), serviceberry (*Amelanchier canadensis*), and Whirled tickseed (*Coreopsis verticillata*) are used here. All tolerate the tough conditions found near roads (*Native Plant Guide Piedmont Region*, 2025).

The second zone is the upland successional meadow. This zone is characterized by soils that hold less moisture due to slope and the moderately well-drained loam in the Russett–Christiana–Urban land complex soils. This zone is expected to become a forested area over time through ecological succession. Through the use of grouped plantings of woody plants from the mesic oak forest plant community acting as nurse species, seed dispersal is encouraged. However, because succession will take time, the herbaceous layer is made up of sun-tolerant meadow species from the Eastern North American ruderal shrub and grassland plant community (NatureServe, n.d.). These include species such as Gray goldenrod (*Solidago nemoralis*), butterfly milkweed (*Asclepias tuberosa*), black-eyed susan (*Rudbeckia hirta*), and little bluestem (*Schizachyrium scoparium*). A selection of woody plants in this zone is the chestnut oak (*Quercus montana*), northern red oak (*Quercus rubra*), and black cherry (*Prunus serotina*) to attract fauna that may help disperse seeds and assist in reforestation (*Native Plant Guide Piedmont Region*, 2025).

A similar grouping of woody plants makes up the Upland forest planting zone. This area is planted as a reforestation of a mesic oak forest rather than as a successional zone because of its direct adjacency to the existing forestland. The suggested plants in this zone include Red oak (*Quercus rubra*) and Willow Oak (*Quercus phellos*). The herbaceous layer includes Blue wood aster (*Symphotrichum*

cordifolium) and blue woodland phlox (*Phlox divaricata*) ("Chapter 4 Maryland's Key Wildlife Habitats," 2016).

In the lowland areas, three planting zones exist. The forest mimics the existing wetland's floodplain-forest wetland condition, while the sunnier area is a wet successional meadow zone with wet prairie and freshwater marsh species, permitting the gradual reforestation of the site. In the wet meadow zone, the proposed plants include swamp white oak (*Quercus bicolor*) and river birch (*Betula nigra*), to act as nurse species, while white turtlehead (*Chelone Glabra*) serves as the Baltimore checkerspot host plant, and cardinal flower (*Lobelia cardinalis*) helps to remove nutrients from the water (*Native Plant Guide Piedmont Region*, 2025; NatureServe, n.d.).

In the wet forest zone, species chosen mimic those found in the natural wetland and take advantage of the shade adjacent to the existing woodland. For this zone, Paw Paw (*Asimina triloba*), Willow Oak (*Quercus phellos*), cinnamon fern (*Osmundastrum cinnamomeum*), and jack-in-the-pulpit (*Arisaema triphyllum*) were chosen. Paw paw, willow oak, and jack-in-the-pulpit benefit pollinators and birds, while the cinnamon fern helps filter the water ("Chapter 4 Maryland's Key Wildlife Habitats," 2016).

In the Wetland and ponding areas, a variety of coastal plan floodplain pond species are proposed. These include Buttonbush (*Cephalanthus occidentalis*), white water lily (*Nymphaea odorata*), Arrow arum (*Peltandra virginica*), and swamp rose mallow (*Hibiscus moscheutos*) ("Chapter 4 Maryland's Key Wildlife Habitats," 2016).

The design establishes five distinct habitat zones in addition to the streetscape. Each zone is planted with a diverse mix of species that deliver ecosystem benefits, including enhanced water infiltration and songbird habitat, while supporting ecological succession and restoration.

Proposed Materials

Paths

The paths in the design are simple. The circulation routes are designed to minimize impervious surfaces while ensuring adequate site access. The primary path, constructed of concrete, connects Driskell Park to the east side of the site and is intended to accommodate the highest volume of visitors from nearby apartments and residential areas. Durability is prioritized for this main circulation route, which is designed to be ADA-compliant with a slope below 5% to ensure universal accessibility. A secondary gravel path provides access from the southeast, linking the neighborhood south of the park to the new landscape and Driskell Park. This path, serving a less densely populated area, utilizes a more permeable material and does not require the same level of durability as the main path.

Maintenance access will be needed for the pond. Because it's main purpose is the catchment and removal of sediment it will need to be routinely dredged to remove excess deposits and clear space for more deposition. For this reason a gravel path was proposed to allow access for equipment while protecting the plant species. This will also allow visitors to reach the water's edge.

Figure 21 Design render showing the entrance path leading to the existing playground.

Overlook Bridge

The bridge is the only structure in the proposal and performs multiple functions. The bridge is necessary to traverse the site due to the topography and stream; however, it is not simply a form of conveyance. The bridge also serves as the site's main observation point. Due to its location directly above the transition from pond to wetlands, it offers views of both habitats. For this reason, the bridge is enlarged to accommodate seating. This invites observers to pause and bear witness to the natural processes around them. Signage on the railings explains the importance of the ecosystems and names species they may witness if they are vigilant. The bridge overlook allows visitors to view the pond and

wetlands clearly without entering the planting areas or disturbing the site. This creates an opportunity to

inspire visitors' interest in the natural environment and in stewardship while also protecting the species and processes that inspire wonder. The materials chosen for the bridge are chosen in response to the site. Because the site is in the floodplain, the bridge has to withstand flood conditions. For this reason, a metal bridge was chosen over a wooden one to be resilient in the floodplain. The decking of the bridge is chosen as a metal grating to reduce impervious surfaces and allow floodwater drainage. Benches are placed along the bridge to encourage people to pause and view the landscape. This also allows the space to be used as a gathering area for socializing or for groups to learn about the site's ecology. The extra benefit of the grated bridge deck is the ability to see through the material to observe the nature directly beneath.

Figure 22 Design render of the observation bridge. The bridge gives visitors the opportunity to observe ecological processes.

Chapter 6: Discussion

Design Evaluation

Biodiversity

Floristic Quality Assessment Calculator

Floristic Quality Assessment (FQA) was used to evaluate the ecological quality of the proposed planting design. In FQA, "vegetation" refers to the mix of plant species in a given area. The method assesses which plant species are present and how closely they are linked to healthy, undisturbed ecosystems. Each plant receives a value indicating its disturbance tolerance: lower values indicate the plant is common and tolerant of disturbance, while higher values indicate the plant is typically found only in undisturbed, natural habitats.

The analysis used the Universal Floristic Quality Assessment Calculator, which applies regional data to evaluate plant communities and secures consistent site comparisons. The proposed design included 65 regionally native plant species. Using only native plants, adapted to local conditions and supporting wildlife, strongly indicates ecological intent and habitat value (Freyman et al., 2016).

The results indicate that the proposed planting design would establish a diverse and ecologically functional plant community. The design incorporates a broad range of plant types, including trees, shrubs, grasses, and flowering plants, which collectively create a layered structure. This structural diversity is significant as it generates multiple habitats within the same area, enabling a greater variety of wildlife species to access food, shelter, and breeding sites.

The assessment further demonstrates that the plant community comprises both hardy, adaptable species and more specialized species typically associated with healthier ecosystems. This balance is essential: adaptable species facilitate landscape establishment in urban environments, while specialized

species contribute to long-term ecological quality and support a broader spectrum of organisms (Freyman et al., 2016).

The Floristic Quality Index (FQI=35.5) and adjusted FQI (44) support this interpretation. These metrics combine species number and ecological characteristics to measure site quality. The values do not indicate a pristine natural system. However, they provide substantial ecological function, especially in a designed landscape in an urban setting.

The planting design covers a range of moisture conditions, from wet pond edges and wet meadows to dry upland areas. This variety creates different habitats and increases overall diversity. More environmental variation supports more species, driving greater biodiversity.

In summary, the FQA results suggest that the proposed design would enhance biodiversity by incorporating a wide array of native species, generating multiple habitat types, and establishing a structurally layered landscape that supports diverse ecological interactions.

Existing vs. Proposed Conditions

An FQA of the existing site vegetation indicates low ecological quality, consistent with the site's previous use as a parking lot. The current plant community is limited in species diversity, dominated by non-native and highly disturbance-tolerant species such as Cynodon dactylon (Bermuda grass) and Microstegium vimineum (Japanese stiltgrass), which offer minimal habitat value. While the species inventory is not comprehensive, it reflects a degraded plant community characteristic of heavily disturbed urban environments.

In contrast, the proposed planting design introduces 65 native species and a more complex vegetation structure. This represents a transition from a landscape dominated by a limited number of hardy, low-value species to one that supports a broader spectrum of plant life and ecological functions. The increase in species richness substantially expands the number of environmental niches, thereby enhancing biodiversity.

The design also introduces plants tied to more stable, less disturbed habitats. This signals improved ecological quality beyond just more species. These plants support specialized habitat conditions and a wider range of wildlife, including pollinators and other organisms dependent on native plants (Freyman et al., 2016).

Although the baseline assessment is based on a limited survey, the contrast between existing and proposed conditions clearly demonstrates improvements in plant diversity and habitat quality. The proposed design transforms the site from a disturbed, low-diversity area into a multi-layered, ecologically functional system that supports significantly greater biodiversity.

Hydrologic and Ecologic Function

WinTR-55 Calculations

(Haahtela et al., 2023)The hydrologic performance of the proposed stormwater wetland was evaluated using the USDA NRCS TR-55 method with WinTR-20. TR-55 estimates runoff depth, peak discharge, and hydrograph response in small watersheds, based on drainage area, land cover, soil, and rainfall deled as a three-cell treatment train: a forebay (Cell 1), a primary wetland (Cell 2), and a polishing wetland (Cell 3). In WinTR-20, each cell was a storage structure defined by a stage-storage-discharge relationship. This setup enables the model to simulate flow magnitude and timing throughout the system. Routing between cells used reach elements, forming a sequential flow path consistent with the site's layout.

The initial modeling results showed a critical design limitation. The system accomplished some peak flow attenuation, but the hydrograph showed a rapid recession. Flow returned to near-zero well before the desired 24–48 hour drawdown range. This indicated the system lacked enough storage or resistance to slow runoff. Smaller outlet structures were considered to increase detention, but the model showed this alone was insufficient and potentially unrealistic.al performance characteristics of wetland-based stormwater treatment systems. While STEPL provides planning-level estimates, the results indicate that

the proposed design delivers meaningful improvements in watershed-scale water quality.

Subsection 2Structure	Acres	Inches	feet	Acre*Feet	Capacity	Percent Treatment
Cell 1	27.81	1.793	0.149416667	4.1552775	0.538	12.95
Cell 2	27.81	1.793	0.149416667	4.1552775	0.65	15.64
Cell 3	27.81	1.793	0.149416667	4.1552775	0.4	9.63
Design Total						38.22

Figure 23 This table shows the calculations for treatment. The calculations show the proposal is projected to treat 38.22% of the watershed runoff.

Water Quality

Calculating Pollution in Runoff Volume

Total runoff volume was calculated by converting the watershed area to acres, converting the runoff depth from inches to feet, and multiplying the area by the runoff depth to obtain acre-feet. Capacity for the forebay was calculated from surface area and pond depth, while capacities for the wetland cells were taken from the WinTR-20 structure rating table at the selected ponding stage. Percent treatment was then estimated as the ratio of cell capacity to total runoff volume. Runoff volume was calculated in acre-feet by converting the watershed area from acres to acres and the runoff depth from inches to feet, then multiplying the two. Treatment capacity was determined for the forebay using its surface area and depth. For the wetland cells, capacity was obtained from the WinTR-20 structure rating table at the specified ponding stage. Finally, the estimated percent treatment was derived from the ratio of the cell capacity to the total runoff volume.

To estimate annual pollutant load reductions associated with the proposed three-cell stormwater wetland system, the NPS STEPL model was used to compare pre- and post-treatment conditions. The system was represented as an equivalent wetland detention BMP applied to an effective treatment area equal to 38.22% of the contributing watershed. This percentage was derived from TR-55 modeling, which

indicated that the system provides storage capacity equivalent to 38.22% of the design-storm runoff volume. Under existing conditions, the watershed generates annual loads of 271.2 lb of total nitrogen (TN), 47.0 lb of total phosphorus (TP), 1,014.5 lb of biochemical oxygen demand (BOD), and 6.5 tons of sediment. After application of the wetland BMP, modeled loads decrease to 250.5 lb TN, 39.1 lb TP, 770.1 lb BOD, and 4.6 tons of sediment. This corresponds to reductions of 20.7 lb TN (7.6%), 7.9 lb TP (16.8%), 244.4 lb BOD (24.1%), and 1.9 tons of sediment (29.6%). These results show that the system is most effective at reducing sediment and organic matter loads, with more moderate reductions in nutrients, reflecting typical performance characteristics of wetland-based stormwater treatment systems. While STEPL provides planning-level estimates, the results indicate that the proposed design delivers meaningful improvements in watershed-scale water quality.

Pollutant	Existing Load	Post-BMP Load	Reduction	Percent Reduction
Nitrogen (TN)	271.2 lb/yr	250.5 lb/yr	20.7 lb/yr	7.60%
Phosphorus (TP)	47.0 lb/yr	39.1 lb/yr	7.9 lb/yr	16.80%
BOD	1,014.5 lb/yr	770.1 lb/yr	244.4 lb/yr	24.10%
Sediment	6.5 ton/yr	4.6 ton/yr	1.9 ton/yr	29.60%

Figure 24 This chart shows the calculated pollution load of the existing conditions versus the proposed design and the projected reduction in pollution load.

Stewardship and Maintenance

The proposed design supports long-term stewardship and maintenance by integrating spatial organization, visual communication, and accessible management strategies.

The inclusion of visible design elements such as defined paths, boardwalks, and structured planting zones provides “cues to care,” which have been shown to increase public acceptance and

engagement with ecologically complex landscapes (Nassauer, 1995). These features communicate intentionality and help users understand how to interact with the site appropriately.

Beyond visual cues, the design promotes active stewardship by organizing plant communities into clearly defined zones. This spatial clarity enables maintenance activities, such as invasive species removal and replanting, to be performed efficiently and with minimal ecological disturbance.

A conceptual maintenance framework is proposed, documenting plant communities by zone and identifying representative species and common invasive threats. This approach could facilitate volunteer-based stewardship by providing clear guidance for seasonal maintenance activities. Although developing a comprehensive maintenance manual is beyond the scope of this study, the design demonstrates that such a system is feasible and aligns with established ecological restoration practices.

Collectively, these strategies demonstrate that the design supports ecological function while also establishing conditions conducive to long-term care and stewardship.

Limitations to the Methods

Several limitations are inherent to the method used in this project. As a conceptual proposal developed through a research-through-design approach, the work is not supported by direct field investigation. Access to the site is restricted, preventing on-site data collection such as soil borings, in-field vegetation surveys, or detailed topographic measurements. Consequently, site inventory and analysis rely on secondary sources and remote data rather than empirical observation. This limitation reduces the accuracy of site understanding and limits the ability to establish a fully validated scientific basis for design decisions. Furthermore, because the project remains conceptual, neither the ecological assumptions nor the proposed design interventions can be empirically tested to verify their performance or outcomes.

The hydrologic modeling used in this study also introduces limitations. The NRCS TR-55 method provides estimates of runoff volume and peak flow based on generalized inputs and simplified hydrologic

assumptions. While appropriate for conceptual analysis, the model does not account for detailed soil characteristics, underground conditions, or groundwater interactions. As a result, the outputs should be understood as approximations rather than exact predictions of site behavior.

Additional uncertainty is present in the soil data used for the project. Soil characteristics are derived from the Web Soil Survey and historical site information rather than site-specific geotechnical testing. Although these sources provide a useful general understanding of soil conditions, they lack the accuracy and resolution of field-based soil analysis. For the project to advance beyond a conceptual proposal, detailed soil testing and expert evaluation would be required to inform design feasibility and construction considerations.

Finally, the evaluation of ecological performance is inherently limited. Successful ecological restoration depends on long-term observation and flexible management to assess outcomes and guide adjustments over time. Because this project is not implemented, such monitoring cannot occur. As a result, the projected ecological benefits stay theoretical and are based on established literature and precedent rather than measurable site performance.

Tradeoffs between Criteria

The design process entails navigating a series of trade-offs among competing criteria, particularly biodiversity, maintenance, ecological function, water quality, and public access. Increasing habitat diversity and ecological complexity inherently introduce increasingly nuanced maintenance requirements. While monoculture landscapes, such as turfgrass, are relatively simple for municipal crews to manage, a green infrastructure-based park represents a move toward more ecologically informed maintenance practices. However, this technique reduces the requirement for frequent mowing, regrading, and soil amendments typically required by conventional lawns. Once established, native plant communities

require minimal inputs, including little to no fertilizer or irrigation, and aid long-term soil improvement through organic matter accumulation and the support of microbial and invertebrate communities.

At the same time, unrestricted human access can negatively impact ecological function. Sensitive habitats, particularly those associated with floodplain and wetland systems, are vulnerable to disturbance from foot traffic, which may degrade vegetation, compact soils, and disrupt ecological processes. This requires a careful balance between access and protection. Design strategies such as clearly defined pathways, overlook areas, and interpretive signage can guide movement and concentrate use in appropriate locations, reducing unintended impacts while maintaining chances for participation. Supporting floodplain processes, in particular, requires limiting entry in certain areas and strengthening the importance of a circulation system that aligns with ecological priorities.

Water quality interventions also introduce tradeoffs. The construction of wetlands and sediment catchment areas requires initial excavation and soil disturbance, which may appear counter to ecological goals. However, these impacts can be reduced through distributed grading strategies that spread disturbance intensity across the site. Additionally, given that existing site soils are already degraded, this process presents an opportunity for soil amendment and long-term improvement. The establishment of native vegetation additionally improves soil conditions over time by contributing organic matter and supporting ecological processes that rebuild soil health.

Designing for the human–nature connection presents another challenge, as the areas most attractive to visitors, particularly the edges of water bodies, are often the most ecologically sensitive and biodiverse. Unmanaged access to these zones can result in habitat degradation and discourage species from establishing. To address this, design interventions must provide opportunities for observation while limiting disturbance. Elevated structures such as boardwalks and overlooks can allow users to experience these environments absent direct contact, while permeable materials can ensure that light and ecological processes are not disrupted.

Perception, too, plays a key role in the success of ecological design. Naturalized landscapes are often viewed as unkempt or unsafe due to dense vegetation and standing water. These perceptions may be addressed through design strategies that improve visibility, demonstrate ongoing maintenance, and communicate intent. As Nassauer (1995) suggests, the use of "cues to care," such as maintained edges and clear organization, along with educational signage, can help align public perception with ecological function.

Ultimately, including these criteria demands a balanced, iterative approach. No single objective can be achieved in isolation without influencing others, and successful design has to carefully negotiate these relationships. By considering the needs of ecological systems alongside human use and perception, the design seeks to maximize benefits across multiple stakeholders, including both human and non-human communities.

Contribution to the Practice of Landscape Architecture

This research is significant to the profession of landscape architecture because it addresses one of the most urgent challenges of our time: climate durability in the built environment. As the effects of climate change become more evident and more people move towards cities, the role of our green spaces must be multifunctional. Public green spaces will need to serve as both a reprieve from urbanization and a place to absorb floodwater, as well as an oasis for native plants and animals amid concrete and asphalt. Landscape architects are ideally placed to provide solutions by bringing together knowledge of ecosystem services, site engineering, and an understanding of human preferences to create spaces that function for all. To summarize, this research accentuates the leadership role landscape architects play in creating resilient, livable cities through nature-based design interventions. This thesis adds to the historical use of parks as ecological infrastructure, but goes beyond thinking of ecosystem benefits, such as "How does this benefit humans?" This project proposes using a public space as infrastructure through leveraging

ecosystem functions. This considers the urban parkland not solely as a human benefit, but as a benefit to all living flora and fauna that access it.

Chapter 7: Conclusion

This thesis contends that converting degraded and fragmented urban floodplain sites into integrated systems directly enhances ecological function, water quality, and public engagement. The proposed design, which incorporates daylighting of stormwater infrastructure and the establishment of a multi-cell wetland treatment system, demonstrates that restoring water's capacity to slow, spread, and infiltrate reestablishes essential ecological and hydrological processes necessary for landscape resilience.

The design enhances habitat and biodiversity by establishing native plant communities appropriate for the site. Additionally, the wetland system improves water quality through sediment removal, filtration, and nutrient uptake. These outcomes demonstrate that ecological function is a primary driver of performance in urban stormwater systems.

In addition to ecological performance, the project emphasizes stewardship and long-term maintenance. By making ecological processes visible and accessible through pathways, viewpoints, and interpretive strategies, the design promotes public engagement and cultivates a sense of responsibility for the landscape. This underscores that effective restoration depends not only on ecological design but also on ongoing human involvement.

The research-through-design methodology demonstrates the value of spatial proposals in testing and integrating these objectives. Although additional technical validation, including soil analysis and detailed engineering, is necessary for implementation, the project offers a replicable framework for integrating ecological restoration, stormwater management, and public use.

The Hyattsville design proposal illustrates these conclusions by applying the project’s design criteria as both a framework for intervention and a basis for evaluation. Ecological and hydrological function are restored through the daylighting of stormwater flow and the creation of a landform that allows water to slow, spread, infiltrate, and interact with soils and vegetation. Water quality is addressed

through a staged treatment system that captures sediment, increases residence time, and filters runoff before it enters the adjacent wetland. Habitat and biodiversity are strengthened through the establishment of multiple native plant communities organized according to site-specific hydrologic and topographic conditions. Stewardship is supported through paths, overlook spaces, and interpretive opportunities that make ecological processes legible to the public while protecting sensitive areas. In this way, the design example demonstrates how the criteria can move beyond abstract goals and operate as practical tools for shaping a resilient and publicly meaningful floodplain landscape.

This thesis demonstrates four key contributions: increased biodiversity, restoration of ecological and hydrological function, water quality improvement, and stewardship. These outcomes are inherently interconnected and are achieved through thoughtful landscape architectural design. This conclusion highlights the transformational potential of integrating these objectives.

Appendices

Full Plant Palette

Woody Plants			
Botanical Name	**Common Name**	**Zones**	**Wetland Indicator Status**
Prunus serotina	Black Cherry	Upland Meadow and Upland Forest	
Acer rubrum	Red Maple	Wet Forest and Streetscape	FAC
Amelanchier arborea	Common servicberry	Upland Forest	
Amelanchier canadensis	Serviceberry	Streetscape	FAC
Asimina triloba	PawPaw	Wet Forest	FAC
Betula nigra	River Birch	Wet Meadow and Wet Forest	FACW
Campsis radicans	Trumpet vine	Wet Forest	FAC

Cephalanthus occidentalis	Buttonbush	Wet Meadow and Pond Edge	OBL
Cercis canadensis	Eastern redbud	Streetscape	
Clethra alnifolia	Sweet pepperbush	Wet Meadow, Wet Forest, and Upland Forest	FAC+
Cornus florida	Flowering dogwood	Upland Forest	
Lindera benzoin	Spicebush	Wet Forest	FACW-
Liquidambar styraciflua	Sweetgum	Wet Forest	FAC
Magnolia virginiana	Sweetbay Magnolia	Wet Meadow and Pond Edge	FACW+
Platanus occidentalis	Sycamore	Wet Meadow, Wet Forest, Streetscape	FACW-
Quercus bicolor	Swamp White Oak	Wet Meadow	FACW+
Quercus montana	Chestnut Oak	Upland Meadow and Upland Forest	

Quercus muhlenbergii	Chinkapin oak	Upland Meadow and Upland Forest	
Quercus palustris	Pin oak	Wet Meadow and Streetscape	FACW
Quercus phellos	Willow Oak	Wet Forest	FAC+
Quercus rubra	Northern Red Oak	Upland Meadow and Upland Forest	
Salix nigra	Black Willow	Wet Meadow	FACW+
Vaccinium corymbosum	Highbush blueberry	Pond Edge	FACW-
Nyssa sylvatica	Black Gum	Wet Meadow, Wet Forest, and Upland Forest	FAC
Perennial Plants			

Botanical Name	**Common Name**	**Zones**	**Wetland Indicator Status**
Andropogon gerardi	Big Bluestem	Wet Meadow	FAC
Arisaema triphyllum	Jack in the Pulpit	Wet Forest	FAC
Asclepias incarnata	Swamp milkweed	Wet Meadow	OBL
Asclepias syriaca	Common milkweed	Upland Meadow and Streetscape	
Asclepias tuberosa	Butterfly milkweed	Upland Meadow	
Carex laxiculmis	Spreading sedge	Wet Forest	
Carex scoparia	Broom sedge	Wet Meadow	FACW
Carex stricta	Tussock Sedge	Wet Meadow	OBL
Carex swanii	Swan's sedge	Upland Forest	
Carex vulpinoidea	Fox Sedge	Wet Meadow	FACW
Chasmanthium laxum	Slender woodoats	Upland Forest	
Chelone glabra	White turtlehead	Wet Meadow	OBL

Coreopsis verticillata	Whorled Tickseed	Streetscape	
Erigeron philadelphicus	Common Fleabane	Streetscape	
Fragaria virginiana	Wild Strawberry	Upland Meadow	
Hibiscus moscheutos	Swamp rose mallow	Pond Water	OBL
Impatiens capensis	Orange jewelweed	Wet Forest	FACW
Iris versicolor	Blue flag iris	Wet Meadow and Pond Edge	OBL
Juncus canadensis	Canada Rush	Wet Meadow	OBL
Juncus Effusus	Soft Rush	Wet Meadow and Pond Edge	FACW+
Juncus tenuis	Path Rush	Wet Meadow	FAC
Lilium superbum	Turk's-cap lily	Upland Forest	
Lobelia cardinalis	Cardinal Flower	Wet Meadow and Pond Edge	FACW+
Mitchella repens	Partridgeberry	Upland Forest	

Nymphaea odorata	White water lily	Pond Water	OBL
Osmunda cinnamomea	Cinnamon fern	Wet Forest	FACW
Osmunda regalis	Royal Fern	Upland Forest	OBL
Panicum virgatum	Switchgrass	Wet Meadow	FAC
Pontedaria cordata	Pickerelweed	Pond Water	OBL
Rhynchospora capitellata	Brownish beaksedge	Wet Meadow	OBL
Rudbekia hirta	Black eyed susans	Upland Meadow	
Schizachyrium scoparium	Little bluestem	Upland Meadow	
Schoenoplectus pungens	Three-square bulrush	Wet Meadow	OBL
Schoenoplectus tabernaemontani	Softstem bulrush	Wet Meadow	OBL
Scirpus cyperinus	Wool grass	Wet Meadow	OBL
Scirpus georgianus	Georgia bulrush	Wet Meadow	OBL
Solidago canadensis	Canada goldenrod	Upland Meadow	

Solidago juncea	Early goldenrod	Upland Meadow	
Solidago nemoralis	Gray goldenrod	Upland Meadow, Streetscape	
Solidago rugosa	Wrinkleleaf Goldenrod	Wet Meadow	FAC
Symphyotrichum ericoides	White heath aster	Streetscape	
Symphyotrichum lateriflorum	Calico aster	Upland Meadow	
Symphyotrichum novae-angliae	New England Aster	Wet Meadow	FACW
Symplocarpus foetidus	Skunk cabbage	Wet Forest	OBL
Vernonia noveboracensis	New York Ironweed	Upland Meadow	
Veronicastrum virginicum	Culver's root	Pond Edge	FACW
Viola sororia	Common blue violet	Upland Meadow	

TR-55 Data

Land Use Details

Sub-area Name: Watershed | Rename | Clear

Land Use Details

Land Use Categories: (•) Urban Area ( ) Developing Urban ( ) Cultivated Agriculture ( ) Other Agriculture ( ) Arid Rangeland

Cover Description	Condition	Area (Acres) for Hydrologic Soil Groups: A	CN	B	CN	C	CN	D	CN
FULLY DEVELOPED URBAN AREAS (Veg Estab.									
Open space (Lawns,parks etc.)									
Poor condition; grass cover < 50%			68		79		86		89
Fair condition; grass cover 50% to 75%			49		69		79		84
Good condition; grass cover > 75%			39		61		74		80
Impervious Areas:									
Paved parking lots, roofs, driveways			98		98		98	7.243	98
Streets and roads:									
Paved; curbs and storm sewers			98		98		98		98
Paved; open ditches (w/right-of-way)			83		89		92		93
Gravel (w/ right-of-way)			76		85		89		91
Dirt (w/ right-of-way)			72		82		87		89
Urban Districts	Avg % Imperv								
Commercial & business	85		89		92		94		95
Industrial	72		81		88		91		93
Residential districts (by average lot size)	Avg % Imperv								
1/8 acre (town houses)	65		77		85		90	6.653	92
1/4 acre	38		61		75		83	12.830	87
1/3 acre	30		57		72		81	1.087	86
1/2 acre	25		54		70		80		85
1 acre	20		51		68		79		84
2 acre	12		46		65		77		82

Project Area(ac): 27.81 | Summary Screen: (•) Off ( ) On | Sub-Area Area (ac): 27.81 | Weighted CN: 91 | Help | Cancel | Accept

Figure 25 Land Use Details shown from the drainage watershed.

```
WinTR-20: Version 1.10                  0         0         0.05
Hyattsville
Austin Thesis

SUB-AREA:
          Watershed R1                  .04345    91.       .122

STREAM REACH:
          R1        R2                  2_Cell_1
          R2        R3                  2_Cell_2
          R3        Out                 2_Cell_3
          Out       Outlet    Xsec 4                  33.

STORM ANALYSIS:
          1-Yr                          2.7       Type II   2

STRUCTURE RATING:
          Cell_3
                    0.00      0.000     0.00
                    0.50      0.990     0.12
                    1.00      2.800     0.24
                    2.00      7.920     0.48
                    5.00      31.305    1.19
                    10.00     88.544    2.38
                    20.00     250.440   4.76
          2_Cell_1
                    0.00      0.000     0.00
                    0.50      1.980     0.13
                    1.00      5.600     0.27
                    2.00      15.839    0.54
                    5.00      62.610    1.35
                    10.00     177.088   2.69
                    20.00     500.879   5.38
          2_Cell_2
                    0.00      0.000     0.00
                    0.50      1.237     0.33
                    1.00      3.500     0.65
                    2.00      9.899     1.30
                    5.00      39.131    3.25
                    10.00     110.680   6.50
                    20.00     313.050   13.00
          2_Cell_3
                    0.00      0.000     0.00
                    0.50      0.990     0.20
                    1.00      2.800     0.40
                    2.00      7.920     0.80
                    5.00      31.305    2.00
                    10.00     88.544    4.00
                    20.00     250.440   8.00

STREAM CROSS SECTION:
          Xsec 4    0.0       0.0       0.0
                    0.0       0.000     0.00      5.00      0.0100
                    0.5       6.197     3.00      7.00      0.0100
                    1.0       21.256    7.00      9.00      0.0100
                    2.0       79.277    18.00     13.00     0.0100
                    5.0       545.728   75.00     25.00     0.0100
                    10.0      2725.818  250.00    45.00     0.0100
                    20.0      15028.559 900.00    85.00     0.0100


          WinTR-20: Version 1.10                0         0         0.05
          Hyattsville
          Austin Thesis

          REA: (continued)
                    Watershed R1                .04345    91.       .122

          STREAM REACH:
                    R1        R2                2_Cell_1
                    R2        R3                2_Cell_2
                    R3        Out               2_Cell_3
          GLOBAL OUTPUT:
                    2         0.05              YYYYN     YYYYNN
```

Figure 26 WinTR20 Report on the projected design outcomes

FQA Calculation for Proposed Design

Thesis Evaluation								
4/7/2026								
Thesis								
Hyattsville								
Prince George								
MD								
FQA DB Region:	*Mid-Atlantic Coastal Plain*							
FQA DB Publication Year:	*2012*							
FQA DB Description:	*Mid-Atlantic Wetland Workgroup (MAWWG). 2012. Floristic Quality Assessment Index (FQAI) calculator.*							
Practitioner:	*Lillian A.*							
Latitude:								
Longitude:								
Weather Notes:								
Duration Notes:								
Community Type Notes:								
Other Notes:								
Private/Public:	*Private*							
Conservatism-Based Metrics:								
Total Mean C:	*4.4*							
Native Mean C:	*4.4*							
Total FQI:	*35.5*							
Native FQI:	*35.5*							
Adjusted FQI:	*44*							
% C value 0:	*0*							
% C value 1-3:	*33.8*							
% C value 4-6:	*55.4*							
% C value 7-10:	*10.8*							
Native Tree Mean C:	*5.1*							
Native Shrub Mean C:	*5*							
Native Herbaceous Mean C:	*4*							
Species Richness:								
Total Species:	*65*							

Native Species:	*65*	*100 %*						
Non-native Species:	*0*	*0%*						
Species Wetness:								
Mean Wetness:	*-1.1*							
Native Mean Wetness:	*-1.1*							
Physiognomy Metrics:								
Tree:	*18*	*27.70%*						
Shrub:	*2*	*3.10 %*						
Vine:	*1*	*1.50 %*						
Forb:	*27*	*41.50%*						
Grass:	*4*	*6.20 %*						
Sedge:	*10*	*15.40%*						
Rush:	*3*	*4.60 %*						
Fern:	*0*	*0%*						
Bryophyte:	*0*	*0%*						
Duration Metrics:								
Annual:	*1*	*1.50 %*						
Perennial:	*64*	*98.50%*						
Biennial:	*0*	*0%*						
Native Annual:	*1*	*1.50 %*						
Native Perennial:	*64*	*98.50%*						
Native Biennial:	*0*	*0%*						
Species:								
Scientific Name	*Family*	*Acronym*	*Native?*	*C*	*W*	*Physiognomy*	*Duration*	*Common Name*
Acer rubrum	*Aceraceae*	*ACRU*	*native*	*1*	*0*	*tree*	*perennial*	*n/a*
Amelanchier arborea	*Rosaceae*	*AMAR3*	*native*	*6*	*1*	*tree*	*perennial*	*n/a*
Amelanchier canadensis	*Rosaceae*	*AMCA4*	*native*	*6*	*0*	*tree*	*perennial*	*n/a*

Andropogon gerardii	*Poaceae*	*ANGE*	*native*	*3*	*0*	*grass*	*perennial*	*n/a*
Arisaema triphyllum	*Araceae*	*ARTR*	*native*	*5*	*-2*	*forb*	*perennial*	*n/a*
Asclepias incarnata	*Asclepiadaceae*	*ASIN*	*native*	*5*	*-5*	*forb*	*perennial*	*n/a*
Asclepias syriaca	*Asclepiadaceae*	*ASSY*	*native*	*1*	*0*	*forb*	*perennial*	*n/a*
Asclepias tuberosa	*Asclepiadaceae*	*ASTU*	*native*	*3*	*0*	*forb*	*perennial*	*n/a*
Asimina triloba	*Annonaceae*	*ASTR*	*native*	*5*	*2*	*tree*	*perennial*	*n/a*
Betula nigra	*Betulaceae*	*BENI*	*native*	*4*	*-3*	*tree*	*perennial*	*n/a*
Campsis radicans	*Bignoniaceae*	*CARA2*	*native*	*2*	*0*	*vine*	*perennial*	*n/a*
Carex laxiculmis	*Cyperaceae*	*CALA18*	*native*	*7*	*0*	*sedge*	*perennial*	*n/a*
Carex scoparia	*Cyperaceae*	*CASC11*	*native*	*4*	*-3*	*sedge*	*perennial*	*n/a*
Carex stricta	*Cyperaceae*	*CAST8*	*native*	*6*	*-5*	*sedge*	*perennial*	*n/a*
Carex swanii	*Cyperaceae*	*CASW*	*native*	*4*	*3*	*sedge*	*perennial*	*n/a*
Carex vulpinoidea	*Cyperaceae*	*CAVU2*	*native*	*2*	*-5*	*sedge*	*perennial*	*n/a*
Cephalanthus occidentalis	*Rubiaceae*	*CEOC2*	*native*	*7*	*-5*	*tree*	*perennial*	*n/a*
Cercis canadensis	*Fabaceae*	*CECA4*	*native*	*6*	*4*	*tree*	*perennial*	*n/a*
Chasmanthium laxum	*Poaceae*	*CHLA6*	*native*	*4*	*0*	*grass*	*perennial*	*n/a*
Chelone glabra	*Scrophulariaceae*	*CHGL2*	*native*	*7*	*-5*	*forb*	*perennial*	*n/a*
Clethra alnifolia	*Clethraceae*	*CLAL3*	*native*	*4*	*-1*	*shrub*	*perennial*	*n/a*
Coreopsis verticillata	*Asteraceae*	*COVE5*	*native*	*5*	*0*	*forb*	*perennial*	*n/a*
Cornus florida	*Cornaceae*	*COFL2*	*native*	*5*	*4*	*tree*	*perennial*	*n/a*
Erigeron philadelphicus	*Asteraceae*	*ERPH*	*native*	*1*	*3*	*forb*	*perennial*	*n/a*
Fragaria virginiana	*Rosaceae*	*FRVI*	*native*	*2*	*3*	*forb*	*perennial*	*n/a*
Hibiscus moscheutos	*Malvaceae*	*HIMO*	*native*	*5*	*-5*	*forb*	*perennial*	*n/a*
Impatiens capensis	*Balsaminaceae*	*IMCA*	*native*	*3*	*-3*	*forb*	*annual*	*n/a*
Iris versicolor	*Iridaceae*	*IRVE2*	*native*	*7*	*-5*	*forb*	*perennial*	*n/a*
Juncus canadensis	*Juncaceae*	*JUCA3*	*native*	*6*	*-5*	*rush*	*perennial*	*n/a*

Juncus effusus var pylaei	*Juncaceae*	*JUEFP2*	*native*	*2*	*-4*	*rush*	*perennial*	*n/a*
Juncus tenuis	*Juncaceae*	*JUTE*	*native*	*1*	*1*	*rush*	*perennial*	*n/a*
Lilium superbum	*Liliaceae*	*LISU*	*native*	*6*	*-4*	*forb*	*perennial*	*n/a*
Lindera benzoin	*Lauraceae*	*LIBE3*	*native*	*5*	*-2*	*tree*	*perennial*	*n/a*
Liquidambar styraciflua	*Hamamelidaceae*	*LIST2*	*native*	*1*	*0*	*tree*	*perennial*	*n/a*
Lobelia cardinalis	*Campanulaceae*	*LOCA2*	*native*	*6*	*-4*	*forb*	*perennial*	*n/a*
Magnolia virginiana	*Magnoliaceae*	*MAVI2*	*native*	*6*	*-4*	*tree*	*perennial*	*n/a*
Mitchella repens	*Rubiaceae*	*MIRE*	*native*	*6*	*3*	*forb*	*perennial*	*n/a*
Nymphaea odorata	*Nymphaeaceae*	*NYOD*	*native*	*4*	*-5*	*forb*	*perennial*	*n/a*
Nyssa sylvatica	*Cornaceae*	*NYSY*	*native*	*6*	*0*	*tree*	*perennial*	*n/a*
Osmunda cinnamomea	*Osmundaceae*	*OSCI*	*native*	*6*	*-3*	*forb*	*perennial*	*n/a*
Osmunda regalis var spectabilis	*Osmundaceae*	*OSRES*	*native*	*6*	*-5*	*forb*	*perennial*	*n/a*
Panicum virgatum	*Poaceae*	*PAVI2*	*native*	*4*	*0*	*grass*	*perennial*	*n/a*
Platanus occidentalis	*Platanaceae*	*PLOC*	*native*	*5*	*-2*	*tree*	*perennial*	*n/a*
Prunus serotina	*Rosaceae*	*PRSE2*	*native*	*3*	*3*	*tree*	*perennial*	*n/a*
Quercus bicolor	*Fagaceae*	*QUBI*	*native*	*8*	*-4*	*tree*	*perennial*	*n/a*
Quercus palustris	*Fagaceae*	*QUPA2*	*native*	*5*	*-3*	*tree*	*perennial*	*n/a*
Quercus phellos	*Fagaceae*	*QUPH*	*native*	*6*	*-1*	*tree*	*perennial*	*n/a*
Quercus rubra	*Fagaceae*	*QURU*	*native*	*6*	*4*	*tree*	*perennial*	*n/a*
Rhynchospora capitellata	*Cyperaceae*	*RHCA12*	*native*	*4*	*-5*	*sedge*	*perennial*	*n/a*
Schizachyrium scoparium	*Poaceae*	*SCSC*	*native*	*2*	*4*	*grass*	*perennial*	*n/a*
Schoenoplectus pungens	*Cyperaceae*	*SCPU10*	*native*	*4*	*4*	*sedge*	*perennial*	*n/a*
Schoenoplectus tabernaemontani	*Cyperaceae*	*SCTA2*	*native*	*4*	*-5*	*sedge*	*perennial*	*n/a*
Scirpus cyperinus	*Cyperaceae*	*SCCY*	*native*	*2*	*-4*	*sedge*	*perennial*	*n/a*
Scirpus georgianus	*Cyperaceae*	*SCGE2*	*native*	*3*	*-5*	*sedge*	*perennial*	*n/a*
Solidago canadensis	*Asteraceae*	*SOCA6*	*native*	*2*	*3*	*forb*	*perennial*	*n/a*

Solidago juncea	*Asteraceae*	*SOJU*	*native*	*2*	*0*	*forb*	*perennial*	*n/a*
Solidago nemoralis	*Asteraceae*	*SONE*	*native*	*2*	*0*	*forb*	*perennial*	*n/a*
Solidago rugosa	*Asteraceae*	*SORU2*	*native*	*2*	*0*	*forb*	*perennial*	*n/a*
Symphyotrichum ericoides	*Asteraceae*	*SYER*	*native*	*9*	*0*	*forb*	*perennial*	*n/a*
Symphyotrichum lateriflorum	*Asteraceae*	*SYLA4*	*native*	*6*	*0*	*forb*	*perennial*	*n/a*
Symphyotrichum novae-angliae	*Asteraceae*	*SYNO2*	*native*	*2*	*0*	*forb*	*perennial*	*n/a*
Symplocarpus foetidus	*Araceae*	*SYFO*	*native*	*5*	*-5*	*forb*	*perennial*	*n/a*
Vaccinium corymbosum	*Ericaceae*	*VACO*	*native*	*6*	*-2*	*shrub*	*perennial*	*n/a*
Veronicastrum virginicum	*Scrophulariaceae*	*VEVI4*	*native*	*7*	*3*	*forb*	*perennial*	*n/a*
Viola sororia	*Violaceae*	*VISO*	*native*	*3*	*1*	*forb*	*perennial*	*n/a*

.

Additional Imagery

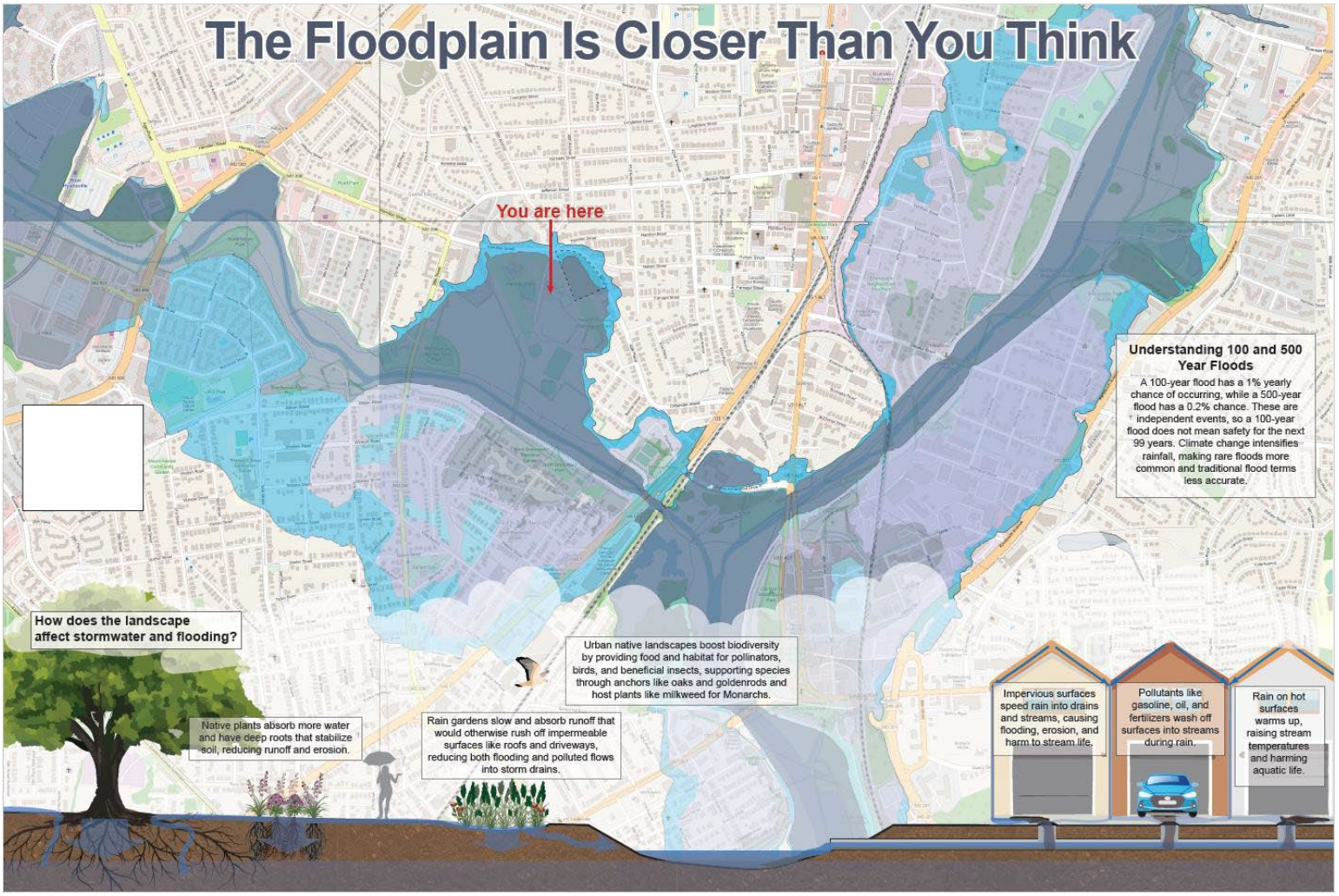

Figure 27 An example of educational signage for the proposed design. Created by the author for a community event.

Bibliography

Aronson MFJ et al. (2014). A global analysis of the impacts of urbanization on bird and plant diversity reveals key anthropogenic drivers. *Proceedings of the Royal Society B*, *281*. http://dx.doi.org/10.1098/rspb.2013.3330

Chapter 4 Maryland's Key Wildlife Habitats. (2016). In *Maryland State Wildlife Action Plan*. https://dnr.maryland.gov/wildlife/Documents/SWAP/SWAP_Chapter4.pdf (Original work published Maryland Department of Natural Resources)

Craft, C. (2022). *Creating and Restoring Wetlands: From Theory to Practice*. Elsevier. http://ebookcentral.proquest.com/lib/umdcp/detail.action?docID=6986113

Dismore, D. (2014, July 31). July 31, 1913: Suffrage Procession Takes Hyattsville By Storm. *Feminist Majority Foundation*. https://feminist.org/news/july-31-1913-suffrage-procession-takes-hyattsville-by-storm/

Fowler, B., Rieder, E., Jackson, S., Shipley, N., Lackey, Q., & Hill, B. (2020). Harnessing a multilevel environmental stewardship framework: A bare necessity for parks and protected areas (Pt. 3). *Parks Stewardship Forum*, *36*, 494–501.

Freyman, W. A., Masters, L. A., & Packard, S. (2016). The Universal Floristic Quality Assessment (FQA) Calculator: An online tool for ecological assessment and monitoring. *Methods in Ecology and Evolution*, *7*(3), 380–383. https://doi.org/10.1111/2041-210X.12491

Gies, E. (2022). *Water always wins: Thriving in an age of drought and deluge*. The University of Chicago Press.

Gobster, P. H., Nassauer, J. I., Daniel, T. C., & Fry, G. (2007). The shared landscape: What does aesthetics have to do with ecology? *Landscape Ecology*, *22*(7), 959–972. https://doi.org/10.1007/s10980-007-9110-x

Google. (2026, 03). *Google Earth*. Retrieved from Maps: https://earth.google.com/

Haahtela, T., Alenius, H., Auvinen, P., Fyhrquist, N., von Hertzen, L., Jousilahti, P., Karisola, P., Laatikainen, T., Lehtimäki, J., Paalanen, L., Ruokolainen, L., Saarinen, K., Valovirta, E., Vasankari, T., Vlasoff, T., Erhola, M., Bousquet, J., Vartiainen, E., & Mäkelä, M. J. (2023). A short history from Karelia study to biodiversity and public health interventions. *Frontiers in Allergy*, *4*, 1152927. https://doi.org/10.3389/falgy.2023.1152927

Jiang, Y., Zevenbergen, C., & Ma, Y. (2018). Urban pluvial flooding and stormwater management: A contemporary review of China's challenges and "sponge cities" strategy. *Environmental Science & Policy*, *80*, 132–143. https://doi.org/10.1016/j.envsci.2017.11.016

Karen Holl. (2020). *Primer of Ecological Restoration*. Island Press. http://proxy-um.researchport.umd.edu/login?url=https://search.ebscohost.com/login.aspx?direct=true&AuthType=ip,uid&db=e025xna&AN=2965730&site=ehost-live

Khirfan, L., Mohtat, N., & Peck, M. (2020). A systematic literature review and content analysis combination to "shed some light" on stream daylighting (Deculverting). *Water Security*, *10*, 100067-. https://doi.org/10.1016/j.wasec.2020.100067

LaGro, J. A., Jr. (2013). *Site Analysis: Informing Context-Sensitive and Sustainable Site Planning and Design*. John Wiley & Sons, Incorporated. http://ebookcentral.proquest.com/lib/umdcp/detail.action?docID=1120063

MD DNR. (n.d.). *How Impervious Surface Impacts Stream Health*. Maryland Department of NAtural Resources.

Morro Bay National Estuary Program. (2026, April 10). Community project spotlight: Beaver Dam Analog Workshop with SLO Beaver Brigade. https://www.mbnep.org/2026/04/10/beaver-dam-analog-workshop/

Narango, D. L., Tallamy, D. W., & Shropshire, K. J. (2020). Few keystone plant genera support the majority of Lepidoptera species. *Nature Communications*, *11*(1), 5751.

https://doi.org/10.1038/s41467-020-19565-4

Nassauer, J. I. (1995). Messy Ecosystems, Orderly Frames. *Landscape Journal*, *14*(2), 161–170.

National Research Council. (2009). Hydrologic, Geomorphic, and Biological Effects of Urbanization on Watersheds. In *Urban Stormwater Management in the United States* (pp. 129–255).

Native Plant Guide Piedmont Region (1st ed.). (2025). University of Maryland Extension Maryland Native Plants Program. https://umd.app.box.com/s/wor658gif8nm79jd7gc0i8m89fbpvojz

NatureServe. (n.d.). NatureServe. NatureServe Explorer. Retrieved March 3, 2026, from https://explorer.natureserve.org/pro/

Nijhuis, S., & de Vries, J. (2019). Design as Research in Landscape Architecture Design as Research in Landscape Architecture. *Landscape Journal*, *38*(1/2), 87–104.

Palmer, M. A., Bernhardt, E. S., Allan, J. D., Lake, P. S., Alexander, G., Brooks, S., Carr, J., Clayton, S., Dahm, C. N., Shah, J. F., Galat, D. L., Loss, S. G., Goodwin, P., Hart, D. D., Hassett, B., Jenkinson, R., Kondolf, G. M., Lave, R., Meyer, J. L., … Sudduth, E. (2005). Standards for Ecologically Successful River Restoration. *Journal of Applied Ecology*, *42*(2), 208–217.

Pollock, M. M., Beechie, T. J., Wheaton, J. M., Jordan, C. E., Bouwes, N., Weber, N., & Volk, C. (2014). Using Beaver Dams to Restore Incised Stream Ecosystems. *BioScience*, *64*(4), 279–290. https://doi.org/10.1093/biosci/biu036

Randolph, J. (n.d.). *Environmental Land Use Planning and Management* (Second). (Original work published 2005, Island Press)

Regenerative Stream Conveyance: Construction Guidance (First). (2018). Maryland Department of Natural Resources. https://dnr.maryland.gov/ccs/Documents/RSC_Training/RSC-Guidance.pdf

Stonedahl, S. H., Harvey, J. W., & Packman, A. I. (2013). Interactions Between Hyporheic Flow Produced by Stream Meanders, Bars, and Dunes. *Water Resources Research*, *49*, 5450–5461. https://doi.org/10.1002/wrcr.20400

Suffrage Petitioners' Automobile Parade to the U.S. Senate, Hyattsville, MD, July 31, 1913. (2026, 2 20). Retrieved from United States Senate: https://www.senate.gov/artandhistory/history/common/image/July311913HyattsvilleLOC.htm

Tetra Tech. (2021). *Final Anacostia TMDL Modeling Report*. Tetra Tech. https://doee.dc.gov/sites/default/files/dc/sites/doee/release_content/attachments/Final%20Anacostia%20TMDL%20Modeling%20Report_508%20web.pdf

The Interagency Workgroup on Constructed Wetlands. (2000, October). Guiding Principles for Constructed Treatment Wetlands: Providing for Water Quality and Wildlife Habitat. Washington, DC: United States Environmental Protection Agency.

Times, H. L. and. (2018, April 18). Unearthing history: Could a piece of suffragette movement be hidden beneath a parking lot? *Streetcar Suburbs Publishing*. https://streetcarsuburbs-newspack.newspackstaging.com/unearthing-history/